MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE.

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INTRODUCTION.

The MONTHLY WEATHER REVIEW for September, 1899, is based on reports from about 3,024 stations furnished by paid and voluntary observers, classified as follows: regular stations of the Weather Bureau, 170; West Indian service stations, 10; cotton region stations, 127; corn and wheat region stations, 133; special river stations, 132; special rainfall stations, 48; voluntary observers of the Weather Bureau, 2,238; Army post hospital reports, 27; United States Life-Saving Service, 14; Southern Pacific Railway Company, 96; Canadian Meteorological Service, 32; Mexican Telegraphic Service, 20; Mexican voluntary stations, 7. International simultaneous observations are received from a few stations and used, together with trustworthy newspaper extracts and special reports.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. Curtis J. Lyons, Meteorologist to the Hawaiian Government Survey, Honolulu; Senor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Señor A. M. Chaves, Director-General of Mexican Telegraphs; Mr. Maxwell Hall, Government Meteorologist, Kingston, Jamaica; Capt. S. I. Kimball, Superintendent of the United States Life-Saving Service; and Capt. J. E. Craig, Hydrographer, United States Navy.

The REVIEW is prepared under the general editorial supervision of Prof. Cleveland Abbe.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time; as far as practicable, only this standard of time is used in the text of the REVIEW, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to conform generally to the modern international system of standard meridians, one hour apart, beginning with Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are sometimes corrected to agree with the eastern standard; otherwise, the local meridian is mentioned.

FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

During the last two days of August, 1899, a West Indian disturbance of moderate strength moved from the vicinity of Dominica and Martinique west-northwest toward the Island of Santo Domingo and on the morning of September 1 was apparently central near Port au Prince, Haiti. During September 1 and 2 the center of this disturbance recurved northward over Haiti, and moving thence northeastward passed near the Bermuda Islands during the 4th.

On the morning of the 8th a storm of pronounced energy appeared east of the Island of St. Kitts, from which position it moved northwestward until the 10th, when it began to recurve to the northward. During the 11th and 12th the recurve changed to the northwestward and the storm passed over the Bermuda Islands during the night of the 12–13th. This storm was quite severe over the more eastern islands of the Leeward group of the Lesser Antilles during the evening and night of the 8th, and also over the Bermuda Islands during the night of the 12th.

The action taken by the Weather Bureau in giving warning of the tropical storms above referred to is indicated in the more detailed descriptions of the storms which follow.

The most important storm of the month in the Lake region occurred on the 24th when wind velocities of 40 to 50 miles an hour were reported at a number of lake stations. A second storm of notable strength crossed the Great Lakes during the night of the 27th and the day of the 28th. The advices and warnings issued in connection with these storms were ample and timely.

The first killing frost of the season occurred in the Dakotas, western Minnesota, and Wyoming on the morning of the 28th, in Nebraska, northern Kansas, eastern Minnesota, western Wisconsin, and Iowa on the morning of the 29th, with light frost as far south as northern Arkansas, and on the morning of the 30th killing frost was reported generally in the Lake region and the middle and lower Ohio Valley, heavy frost was noted at Memphis, and light frost in central and eastern parts of Tennessee. Ample warnings were issued in connection with the frosts referred to.

In the Pacific coast districts the weather of the month was not marked by specially notable features.

THE WEST INDIAN DISTURBANCE OF AUGUST 29–SEPTEMBER 4, 1899.

This disturbance was of moderate strength throughout a course which lay from a point east of Guadaloupe to a position south of Santo Domingo from the 29th to the 31st of August, thence northwest and north over western Haiti, and thence northeastward to the vicinity of the Bermuda Islands by September 4. Shipping and other interests were advised of the approach and character of this disturbance and pre-

cautions which were justified by reports were recommended. Observations taken on the U. S. Transport *Kilpatrick* on September 3, when in about latitude north 25°, longitude west 68° 35′, show that hurricane winds were encountered in that position. It appears, therefore, that while the storm possessed but moderate intensity over the Caribbean Sea, Santo Domingo, and Haiti it acquired great strength after its recurve northward and northeastward over the ocean.

THE WEST INDIAN HURRICANE OF SEPTEMBER 8-13, 1899.

The center of this hurricane did not reach any of the islands of the West Indies, and the winds of its west quadrants were severely felt only over the outlying Leeward Islands of the Lesser Antilles.

On September 7 the Central Office of the Weather Bureau at Washington advised its observers in the eastern West Indies that conditions were threatening over the Lesser Antilles, and to be alert to take local action if necessary. The morning of the 8th the approach of a severe storm from the eastward of St. Kitts was indicated, and hurricane signals were ordered on that island, and advisory messages were telegraphed to all other observers in the threatened district. It was calculated at that time that the hurricane would reach only the extreme northeast islands, and subsequent events show that this was a correct calculation. At St. Kitts the wind reached a velocity of 62 miles an hour at 8:18 p. m. of the 8th, and an extreme velocity for one minute of 120 miles an hour was recorded at 5:51 p. m. The islands to the east and northeast of St. Kitts experienced correspondingly severe winds, and reports from vessels show that the violence of the hurricane did not lessen during its subsequent northwest, north, and northeast course over the ocean. During the night of the 12–13th the hurricane center passed over or very near the Bermuda Islands, causing considerable damage in that group.

The following reports are descriptive of the hurricane and indicate the character of the action taken by the Weather Bureau in issuing warnings of its approach:

Basseterre, St. Kitts, W. I., W. H. Alexander, Observer, Weather Bureau:

The day preceding the hurricane was marked by considerable haze, a red sunset, low barometer, and a clear, smooth sea. The night preceding the hurricane a close watch was kept on the weather, and at 5 a. m., local time, a precautionary warning was issued quickly and thoroughly by telephone, and the information was telegraphed to the United States Consul at Antigua, which is about 60 miles east from St. Kitts. At 11:41 a. m. an order to hoist the hurricane signal was received from Washington. The storm began at 3:40 p. m., nearly ten hours after the first warning was issued, and three hours after the actual display of the signals. There was neither thunder nor lightning during the storm. The total rainfall was 3.13 inches, the heaviest fall occurring during the first two hours of the storm. The variations in temperature were very slight, and the clouds, though rapid in motion, did not present such a confusion and whirling as characterized the clouds during the storm of August 7, 1899. (The maximum wind velocities are given in a table on another page of this REVIEW). The lowest barometer, 29.506, was reached at 5 p. m. on the 8th.

This hurricane, as compared with that of August 7, was slightly less intense, and far less disastrous, owing, no doubt, to the fact that only the strong trees and buildings were left, and these were able to successfully resist the attacks of the weaker storm. Otherwise there would have been very much the same story to tell. A few small huts were destroyed, rendering about 200 people homeless; two schooners, with cargoes, total value $25,000, wrecked; one small boat, valued at $240, wrecked, and cane crop badly damaged. The neighboring islands to the east suffered about the same as St. Kitts, except the little island of Anguilla, where as many as 200 houses were demolished and 800 people were rendered homeless. The steamship *Caracas*, of the Red D Line, met the storm 400 miles north of Porto Rico, and experienced its fury from midnight on Saturday until Monday morning. In about the same region the schooner *Isaac Newton* was dismasted and waterlogged on Sunday, the 10th. The crew of this schooner, when rescued on the 13th by the steamship *Fontabelle*, were standing in water waist deep, and had been without food and fresh water for three days. They report the occurrence, during the hurricane, of a severe hailstorm, lasting about half an hour, and producing intense cold. The hailstones were very large, and fell with great force. The steamship *Fontabelle* encountered the hurricane at midnight the 11th, in latitude 29° 20′ N. and longitude 68° 20′ W. From 2 to 8:30 a. m. of the 12th the wind blew at an estimated velocity of 90 miles per hour, first from east-southeast, then backing to east-northeast, after which, with diminished force, it backed to southwest. Heavy rain fell from 1:30 a. m. to 4:30 a. m. The lowest pressure noted was 28.40 inches. The Captain reports the loss of a large quantity of deck cargo and live stock, also that the storm was intensely severe, and that the escape of the vessel from damage was remarkable.

On the morning of the 9th the following message was sent to the central office of the Canadian Meteorological Service at Toronto, through which reports from Bermuda are transmitted to this Bureau:

Hurricane central northeast of Porto Rico, moving northwest, and is likely to pass near Bermuda.

Similar messages were at the same time sent to the New York and Philadelphia Maritime Exchanges and to the Press Associations. The hurricane reached Bermuda the night of the 12th; hence the message above quoted gave warning of the storm three days in advance of its arrival.

The following, which shows the violent nature of this hurricane during its passage over or near the Bermuda Islands, is furnished by the Associated Press:

Island of Bermuda, September 13.—A hurricane swept over this island last night. Many houses were blown down and others were unroofed. The storm raged during all of last night. No lives were lost, but heavy damage was done to public and private property, fruit and cedar trees. The causeway was wrecked and the government house was damaged.

The weather looked threatening early Tuesday morning, with a falling barometer. The storm began with heavy rain at 2 p. m., after which there was a slight lull for a few hours, with the wind south-southeast and the barometer steadily falling. The wind suddenly backed to east, blowing with cyclonic gusts. From 8 p. m. to midnight it blew with hurricane force and was at its worst from 1 a. m. to 1:45 this morning, when, after a lull, the wind changed to the southwest, when the principal damage was done. Giant cedars were uprooted, ornamental and fruit trees were destroyed, and wharfs were washed into the sea. All communication with St. Georges was cut off and news from the western end of the island and the dockyard is not procurable at present. The telephone and telegraph poles and wires are down, causing a total interruption of business.

There has been considerable damage at the military camp. The city hall, public gardens and hotels, and several public and private dwellings were also damaged, and numerous small craft in the harbors were sunk or driven ashore. The British steamer *Duart Castle*, Captain Seeley, from Halifax, September 8, for the Windward Islands and Demarara, was to have left port at 4 p. m. yesterday, but the storm delayed her sailing.

Cedar avenue was practically ruined, many of its trees being prostrated, and others are badly injured. The storm was the worst known here since the hurricane of 1880; in fact, many of the inhabitants say it exceeded that of 1880 in violence. The weather now is moderating and the barometer is rising. It is rumored that damage amounting to £100,000 has been done at the dockyard alone.

On Ireland and Boaz Islands everything is more or less injured. The damage is roughly estimated at £100,000. At Somerset all the boats and small craft were destroyed, trees demolished, and houses unslated and otherwise damaged. At Prospect Camp the damage is estimated at £3,000.

More than half a mile of the causeway connecting the mainland with St. Georges is totally destroyed. It will cost £13,000 to repair it. News from St. Georges, received by a whaleboat, says serious damage has been done there to trees, houses, etc. All the boats have been destroyed or badly injured.

Reports from outlying parishes are slowly coming in. They all show that there has been great destruction of trees and serious injury to houses and other property. From what can be learned here there has been no loss of life. It is a curious coincidence that the great gale of 1839 occurred on September 11 and 12 and this one was on September 12 and 13. No correct estimate of the amount of damage to private property can at present be obtained, but it will be fully £100,000.

From press reports received it appears that this hurricane advanced from Bermuda to the vicinity of the Newfoundland coast, where on the night of the 14th violent gales occurred which caused considerable damage to fishing craft and the loss of four lives.

CHICAGO FORECAST DISTRICT.

During the early part of the month exceptionally warm weather prevailed throughout the greater portion of the district, the September maximum temperature record being broken at many stations. The break in the hot wave of the 7th, 8th, and 9th was successfully forecast, and the work of the Weather Bureau at the time was strongly commended by the Chicago Press.

Warnings were issued well in advance of all frosts of a serious character, September 18th, 19th, 25th, 28th, and 29th. The area covered by the killing frosts on the mornings of the 29th and 30th was closely outlined in the forecasts issued the previous days. It is not known what value these frost warning were, as nearly all crops liable to damage had been harvested.

In the squall of the 24th an unseaworthy steamer, *Cleveland*, was sunk at the entrance to the Chicago Harbor, and the tug *Dorr* sprung a leak and foundered a few miles off south Chicago.

During the 26th a storm developed in the British Northwest, and on the morning of the 27th the center was near Winnipeg. During the succeeding twenty-four hours it moved across the upper Lake region with increasing intensity. Southwest signals were ordered up September 27th at 10 a. m., on Lakes Michigan and Superior, Mackinac section, and Lake Pepin. On the evening of the 27th the signals were extended over Lake Huron. The following morning the signals on Lakes Michigan and Superior were changed to northwest. This was the first severe and general storm of the season in this section, and its movement was marked by high winds at all upper Lake ports. On account of the signal orders and warnings having been issued well in advance of the storm's movement, all vessels had an opportunity to run to shelter in harbor or seek protection under a lea shore.

A long range forecast for Duluth and vicinity for September 12th to 15th, inclusive, was issued at Chicago at 2 p. m., September 11th, in answer to a request from Mr. H. W. Richardson, Local Forecast Official. An excellent opportunity for making a long range forecast presented itself, as the weather map indicated a continuance of settled conditions. That the forecast was of value and much appreciated by the people of Duluth was shown by comments in the Duluth Evening Herald of September 18.—*H. J. Cox, Professor.*

SAN FRANCISCO FORECAST DISTRICT.

The weather has been generally clear over the entire district. Light rains occurred on the coast in northern California on September 4, and thunderstorms occurred in eastern Arizona on September 8. Rain fell on the northern coast of California on September 28, and it is interesting to note that this first rain of the winter type was forecast. The beginning of the month was unusually cold and cloudy in the fruit drying districts of California, and raisin makers felt somewhat anxious for their crops. On September 6, from some studies made at Mount Tamalpais, a forecast of warm weather for forty-eight hours was made in the interest of the raisin makers, and on succeeding dates similar forecasts were issued. These were all verified. The curing season up to date has been very favorable.

The month has been marked by a great frequency of fog along the coast. Here again the conditions on Mount Tamalpais have been used in the practical work of forecasting. It has been noted that when the vertical thermal gradient is one degree rise for every 60 or 80 feet the conditions are favorable for heavy fog in the Bay of San Francisco and outside the heads. A number of minor accidents occurred to vessels during the month on account of the fog.

On September 22 there was a sudden rise in temperature (19° in twenty minutes) at San Diego. This was the warmest day of the season. It was not forecast. The phenomenon is probably connected with the wind from the desert.

Several times during the month the determination of the conditions at a height of about 4,000 feet above sea level by means of kites, and on three occasions all night records, were obtained.—*Alexander G. McAdie, Forecast Official.*

PORTLAND, OREG., FORECAST DISTRICT.

No wind signals were displayed during the month.

No formal frost warnings were issued during the month, though information was given in the synopsis that frosts were probable in certain sections. Light frosts did occur but no damage was done.

Rain warnings were issued on several dates, and as a rule they were fully verified. Mr. George H. Greer, a large farmer of Dundee, Yamhill County, Oreg., writes under date of September 16, 1899, as follows:

> The farmers were eager to learn what your Bureau thought of the weather. Your remarkably accurate and far reaching view was very truly a comfort, especially from Tuesday to Friday (12th to 15th.)

The August rains were unusual and when in September rain began to fall considerable anxiety was caused in the business community as well as among the farmers. The forecasts and synopses were read with more than ordinary interest, and the information issued from this office allayed the fear which prevailed that the fall rains had set in.

Special crop reports were issued during the month in connection with the synopses on the morning maps; evening newspaper reports were given when occasion required. The value of the work of the Bureau to the farmers and to the business people has been demonstrated more clearly during the last two months than ever before.—*B. S. Pague, Forecast Official.*

WEST INDIAN FORECAST DISTRICT.

The month opened with a tropical cyclone southeast of Santiago, Cuba. Advisory information regarding the disturbance, received the evening of August 31, was given wide dissemination. The following message was received from Washington the evening of the 1st:

> Storm center 4 p. m. south of and near Santiago, moving west-northwest; slightly increased energy. Vessels sailing from Cuban ports and those west from Santo Domingo and Haiti should take every precaution.

This information was telegraphed to all regular and display stations on the Island of Cuba and to Santo Domingo, and to all newspapers that could be reached.

At 1:44 p. m. of the 2d the following was received from Washington:

> Tropical storm near Windward Passage; continued strong northeast winds on Florida and north Cuban coasts for a day or two; high seas.

The following was received from Washington at 9 p. m.:

> Storm apparently recurved and central north of Santo Domingo and Haiti, moving northward; little energy. Caution advised vessels sailing in that direction; stations notified.

This information was communicated to all interests.

The Barbados morning report of September 7 showed disturbed conditions to the northeastward of that station. A report from Barbados, timed 12:20 p. m., contained the following:

> Barometer irregular; unusual increase in height of sea on east coast.

The morning reports of September 8 showed the storm to be central southeast of St. Kitts and a maximum wind velocity of 30 miles was reported, the only high wind.

The following was received from Washington at 11:59 a. m.:

Hurricane signal has been ordered at St. Kitts; storm central east of that island apparently moving northwest.

Advisory messages had been sent direct to all stations from Washington, and the usual disposition of such messages was made locally. The morning reports of September 9 showed the storm center to the northeast of Porto Rico, and conditions indicated the passing of the hurricane to the north-northwest. By the morning of the 10th the hurricane had progressed so far northward that all West Indian stations were beyond its influence.—*W. B. Stockman, Forecast Official.*

AREAS OF HIGH AND LOW PRESSURE.

During September there were nine highs and ten lows sufficiently well defined to have their paths traced on Charts I and II.

The accompanying table presents the principal points regarding the first and last appearance, and velocity of these conditions, and the following statement is added:

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocities.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long W.	Length.	Duration.	Daily.	Hourly.
High areas.		°	°		°	°	Miles.	Days.	Miles.	Miles.
I	1, a. m.	47	129	5, p. m.	45	59	3,300	4.5	733	30.5
II	3, a. m.	35	123	11, a. m.	47	59	4,680	8.0	585	24.4
III	4, p. m.	54	117	8, p m.	32	79	3,240	4.0	810	33.7
IV	8, p. m.	48	120	18, a. m.	41	68	3,440	9.5	362	15.1
V	11, p. m.	40	126	17, p. m.	34	101	3,900	6.0	650	27.1
VI	17, a. m.	51	116	23, a. m.	36	83	3,780	6.0	630	26.3
VII	20, a. m.	49	113	25. a. m.	47	55	2,820	5.0	564	23.5
VIII	20, p. m.	47	127	29, p. m.	46	57	4,440	9.0	493	20.5
IX	26, p. m.	42	126	*5, a. m.	38	73	4,260	8.5	251	10 4
Total							33,860	60.5	5,078	211.5
Mean of 9 paths							3,762		564	23.5
Mean of 60.5 days									560	23.3
Low areas.										
I	†30, p m.	45	122	5, a. m.	48	51	3,540	5.5	644	26.8
II	2, p. m.	44	119	7, a. m.	48	55	3,840	4.5	853	34.5
III	4, a. m.	48	128	9, a. m.	49	53	3,480	5.0	696	29.0
IV	8, p. m.	50	114	12, a. m.	41	70	2,520	3.5	720	30.0
V	10, p. m.	54	106	14, p. m.	46	57	3,660	4.0	915	38.1
VI	11, p. m.	47	121	14, p. m.	49	108	1,440	3.0	480	20.0
VII	14, p. m.	53	112	17, p. m.	48	75	2,040	3.0	680	28.3
VIII	17, p. m.	27	84	21. p. m.	51	64	2,340	4.0	585	24.4
IX	21, p. m.	53	116	27, a. m.	48	70	3,480	5.5	633	26.4
X	25, p. m.	55	116	30, p. m.	50	66	2,460	5.0	492	20.5
Total							28,800	43.0	6,698	279.0
Mean of 10 paths							2,880		670	27.9
Mean of 43.0 days									670	27.9

*October. †August.

Highs.—Numbers II, V, and IX were first noted on the middle Pacific coast; Nos. I, IV, and VIII, on, or near the north Pacific coast, and the remaining three to the north of Montana. The general tendency of the paths is toward the east, or south of east. No. V was last seen in the panhandle of Texas; No. VI in east Tennessee; No. III off the south Atlantic coast; Nos. IV and IX off the middle Atlantic coast; the remaining highs disappeared near Newfoundland. An interesting fact connected with these highs is the very large number of days covered by them, 60.5. This is the largest number of days noted in the past three years.

Lows.—Of the lows, Nos. I, II, III, and VI were the first noted on or near the north Pacific coast; No. VIII was first seen off the west coast of Florida; the remaining storms moved east or northeast, and all were last seen over Newfoundland or near the mouth of the St. Lawrence, except No. IV, which disappeared off the middle Atlantic coast. The month was remarkable for its light winds. On the p. m. of 11th, as storm No. V approached the lower lakes, New York reported an easterly gust of 60 miles an hour. On the afternoon of 24th, while storm No. IX was over Lake Huron, Cleveland reported a southeast wind of 40 miles, and the next morning Buffalo had a south wind of 48 miles. On the morning of 28th, as storm No. X approached the upper lakes, Chicago reported a west wind of 48 miles; as the same storm passed down the St. Lawrence Valley on the evening of 30th, it caused a northwest wind of 42 miles at New York City.—*H. A. Hazen, Professor.*

RIVERS AND FLOODS.

The low water season is at hand, and the river stages as a rule steadily declined throughout the month. There was a temporary sharp rise in the rivers of the South Atlantic States on the 11th and 12th, due to heavy local rains, but nothing of interest transpired.

The highest and lowest water, mean stage, and monthly range at 123 river stations are given in the accompanying table. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are: Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.—*H. C. Frankenfield, Forecast Official.*

Heights of rivers referred to zeros of gages, September, 1899.

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Mississippi River.	Miles.	Feet.	Feet.		Feet.		Feet.	Feet.
St. Paul, Minn	1,954	14	7.5	1	4.5	30	5.6	3.0
Reads Landing, Minn	1,884	12	4.7	2,3	2.2	30	3.5	2.5
La Crosse, Wis	1,819	12						
North McGregor, Iowa	1,759	18	4.9	6-8	3.1	30	4.2	1.8
Dubuque, Iowa	1,699	15	4.6	7-9	3.1	30	4.0	1.5
Leclaire, Iowa	1,609	10	2.6	10-12	1.7	1	2.3	0.9
Davenport, Iowa	1,598	15	3.7	10, 11	2.6	1	3.3	1.1
Muscatine, Iowa	1,562	16	4.7	10, 11	3.2	1	4.2	1.5
Galland, Iowa	1,472	8	1.8	11-15	1.1	1	1.6	0.7
Keokuk, Iowa	1,463	14	2.8	12, 13	1.5	1, 2	2.3	1.3
Hannibal, Mo	1,402	17	3.8	{13-16 {18, 19	2.4	1, 2	3.4	1.4
Grafton, Ill	1,306	23	4.8	20	3.2	1, 2	4.1	1.6
St. Louis, Mo	1,264	30	7.5	1, 2	5.0	29, 30	6.3	2.5
Chester, Ill	1,189	36	5.3	1-3	3.2	30	4.3	2.1
Memphis, Tenn	843	33	5.5	1	2.2	30	3.3	3.3
Helena, Ark	707	42	9.2	1	4.6	30	6.0	4.6
Arkansas City, Ark	635	42	10.0	1	4.0	23-26, 30	5.6	6.0
Greenville, Miss	595	42	8.5	1	3.7	30	5.2	4.8
Vicksburg, Miss	474	45	9.6	1	2.3	30	4.5	7.3
New Orleans, La	108	16	4.6	1	3.3	21, 29, 30	3.9	1.3
Missouri River.								
Bismarck, N. Dak	1,309	14	3.7	1	2.0	28-30	2.8	1.7
Pierre, S. Dak	1,114	14	4.3	1	2.5	28	3.3	1.8
Sioux City, Iowa	784	19	7.9	2	5.0	29	6.0	2.9
Omaha, Nebr	669	18	8.4	1,3	6.7	30	7.6	1.7
Plattsmouth, Nebr	641							
St. Joseph, Mo	481	10	4.3	1	1.2	30	2.5	3.1
Kansas City, Mo	388	21	10.0	1	5.9	30	7.6	4.1
Boonville, Mo	199	20	9.3	1	5.7	30	7.0	3.6
Hermann, Mo	103	24	8.6	1	5.3	30	6.7	3.3
Illinois River.								
Peoria, Ill	135	14	4.3	18, 19	3.7	1-3, 5	4.0	0.6
Youghiogheny River.								
Confluence, Pa	59	10	4.4	12	0.4	7	1.3	4.0
West Newton, Pa	15	23	4.5	12	0.1	6-8	0.8	4.4
Allegheny River.								
Warren, Pa	177	7	0.3	2	0.0	7-30	0.0	0.3
Oil City, Pa	128	13	1.4	3	— 0.1	1	0.3	1.5
Parkers Landing, Pa	73	20	1.3	2	0.0	1	0.7	1.3
Monongahela River.								
Weston, W. Va	161	18	— 0.6	{12, 13 {21, 22	— 1.6	10	—1.1	1.0
Fairmont, W. Va	119	25	0.8	13, 14	0.2	1-7	0.5	0.6
Greensboro, Pa	81	18	9.2	11	6.4	1-3, 6-8	6.8	2.8
Lock No. 4, Pa	40	28	11.0	12	6.1	1, 21, 22	7.7	4.9

Heights of rivers referred to zeros of gages—Continued.

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Conemaugh River.	*Miles.*	*Feet.*	*Feet.*				*Feet.*	*Feet.*
Johnstown, Pa	64	7	2.4	12	1.2	{7,8,18,19/24,25,30}	1.4	1.2
Red Bank Creek.								
Brookville, Pa	35	8	1.4	2	— 0.2	1	0.3	1.6
Beaver River.								
Ellwood Junction, Pa	10	14	— 0.1	{3,4,6,8,/9,11-13}	— 0.3	{16-18/23-25}	—0.2	0.2
Great Kanawha River.								
Charleston, W. Va	61	30	7.0	{5,6,13/17,18}	6.4	29	6.8	0.6
New River.								
Hinton, W. Va	95	14	2.2	21,22	1.1	18,19	1.4	1.1
Cheat River.								
Rowlesburg, W. Va	36	14	2.4	13	1.0	{21,24-26/28-30}	1.5	1.4
Ohio River.								
Pittsburg, Pa	966	22	7.6	12	2.6	3	5.7	5.0
Davis Island Dam, Pa	960	25	6.5	12	1.6	23	2.8	4.9
Wheeling, W. Va	875	36	5.9	13,14	1.0	26	2.6	4.9
Parkersburg, W. Va	785	36	6.8	15	1.9	27	3.4	4.9
Point Pleasant, W. Va	703	39	4.4	16	1.5	30	2.7	2.9
Catlettsburg, Ky	651	50	4.7	18	1.3	30	2.8	3.4
Portsmouth, Ohio	612	50	6.1	18	2.3	1	3.9	3.8
Cincinnati, Ohio	499	50	7.0	20	3.7	3,4	5.1	3.3
Louisville, Ky	367	28	5.3	24,25	2.3	5,6	3.6	3.0
Evansville, Ind	184	35	3.6	25	1.9	10	2.8	1.7
Paducah, Ky	47	40	2.1	1	1.1	16,17	1.4	1.0
Cairo, Ill	1,073	45	7.6	1	4.9	30	6.0	2.7
Muskingum River.								
Zanesville, Ohio	70	20	6.1	5	5.6	17	5.8	0.5
Miami River.								
Dayton, Ohio	69	18	1.2	20	0.6	30	0.9	0.6
Wabash River.								
Mount Carmel, Ill	50	15	0.8	1	0.3	30	0.5	0.5
Licking River.								
Falmouth, Ky	30	25	0.5	9-19,30	0.3	23-28	0.4	0.2
Clinch River.								
Speers Ferry, Va	156	20	0.0	11	— 0.6	1,5,6,18	—0.4	0.6
Clinton, Tenn	46	25	3.6	15	2.0	25,26	2.8	1.6
Tennessee River.								
Knoxville, Tenn	614	28	1.0	2	— 0.7	19	—0.2	1.7
Kingston, Tenn	534	25	0.6	1,2,9,24	0.3	{6,7,11-14/18-20/28-30}	0.4	0.3
Chattanooga, Tenn	430	33	3.1	4	1.0	21,22	1.7	2.1
Bridgeport, Ala	390	24	1.5	5	0.1	23,24	0.6	1.4
Florence, Ala	220	16	0.9	7,8	— 0.1	26	0.3	1.0
Riverton, Ala	190	25	0.3	8	— 1.8	25-27	—1.0	2.1
Johnsonville, Tenn	94	21	1.6	9	0.1	28,29	0.7	1.5
Cumberland River.								
Burnside, Ky	434	50	0.2	1	— 0.7	24	—0.4	0.9
Carthage, Tenn	257	40	0.7	1	— 0.1	{13-15/17,18}	0.2	0.8
Nashville, Tenn	175	40	1.3	1,9	0.6	15-28	0.8	0.7
Arkansas River.								
Wichita, Kans	720	10	2.4	10	1.5	7	1.9	0.9
Webbers Falls, Ind. T	407	23	1.8	1	1.4	12-30	1.5	0.4
Fort Smith, Ark	345	22	3.0	1,2,24	1.9	17-23	2.4	1.1
Dardanelle, Ark	250	21	2.4	1	1.4	21	1.8	1.0
Little Rock, Ark	170	33	3.8	1	2.8	22,23	3.2	1.0
White River.								
Newport, Ark	150	26	1.5	1,20	0.9	30	1.2	0.6
Yazoo River.								
Yazoo City, Miss	80	25	— 0.2	1	— 2.2	28-30	—1.6	2.0
Red River.								
Arthur City, Tex	688	27	8.5	24	5.4	15,16	6.5	3.1
Fulton, Ark	565	28	6.6	28	2.7	20,21	4.0	3.9
Shreveport, La	449	29	1.8	1	— 0.2	24	0.8	2.0
Alexandria, La	139	33	0.8	1	— 2.0	28-30	—1.0	2.8
Ouachita River.								
Camden, Ark	340	39	3.1	1,2	2.7	30	2.9	0.4
Monroe, La	100	40	0.5	1-14	0.0	28-30	0.3	0.5

Heights of rivers referred to zeros of gages—Continued.

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Atchafalaya Bayou.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Melville, La	100*	31	11.2	1	3.1	30	5.7	8.1
Susquehanna River.								
Wilkesbarre, Pa	178	14	0.0	1,2	— 2.0	19-24	—1.2	2.0
Harrisburg, Pa	70	17	1.8	1	0.6	19	1.0	1.2
W. Br. of Susquehanna.								
Williamsport, Pa	35	20	1.5	2-5	0.3	{22,23/25-28}	0.8	1.2
Juniata River.								
Huntingdon, Pa	80	24	5.0	12	3.0	1-11,14-30	3.1	2.0
Potomac River.								
Harpers Ferry, W. Va	170	16	2.0	13	0.9	10,11	1.3	1.1
James River.								
Lynchburg, Va	257	18	2.6	20	0.1	3-8,15-19	0.4	2.5
Richmond, Va	110	12	0.8	11	— 2.8	29	—1.2	3.6
Roanoke River.								
Weldon, N. C	90	40	15.5	22	7.3	19,20	8.1	8.2
Cape Fear River.								
Fayetteville, N. C	100	38	5.7	12	1.4	7	2.7	4.3
Lumber River.								
Fairbluff, N. C	10	6	1.4	14	0.1	9,10	0.7	1.3
Edisto River.								
Edisto, S. C	75	6	4.7	2	1.4	30	2.9	3.3
Pedee River.								
Cheraw, S. C	145	27	6.9	12	1.0	28-30	1.8	5.9
Black River.								
Kingstree, S. C	60	12	3.5	19-23,29	1.3	1	3.0	2.2
Lynch Creek.								
Effingham, S. C	35	12	4.8	17	2.5	1,9,28,30	3.2	2.3
Santee River.								
St. Stephens, S. C	50	12	6.8	17	0.0	30	3.8	6.8
Congaree River.								
Columbia, S. C	37	15	4.5	12	— 0.2	17	0.6	4.7
Wateree River.								
Camden, S. C	45	24	18.8	12	3.0	26	5.4	15.8
Waccamaw River.								
Conway, S. C	40	7	4.0	1,2	1.2	30	2.6	2.8
Savannah River.								
Calhoun Falls, S. C	347	.....	3.0	{1,8,9/12,13}	2.2	30	2.8	0.8
Augusta, Ga	268	32	13.9	1	3.9	18	6.7	10.0
Broad River.								
Carlton, Ga	30	.....	3.8	1	1.9	{24,25/29,30}	2.2	1.9
Flint River.								
Albany, Ga	80	20	0.6	5,6,18,19	— 0.5	28-30	0.2	1.1
Chattahoochee River.								
West Point, Ga	239	20	2.5	1,17	1.1	24	2.0	1.4
Coosa River.								
Rome, Ga	225	30	3.4	1	0.4	30	1.1	3.0
Gadsden, Ala	144	18	2.9	2	— 0.8	29,30	0.0	3.7
Alabama River.								
Montgomery, Ala	265	35	3.1	1	— 0.3	29,30	0.9	3.4
Selma, Ala	212	35	4.8	4	— 1.1	29,30	1.2	5.9
Tombigbee River.								
Columbus, Miss	285	33	— 1.3	1	— 3.8	{11,18/29,30}	—3.4	2.5
Demopolis, Ala	155	35	0.0	1	— 3.2	28-30	—2.4	3.2
Black Warrior River.								
Tuscaloosa, Ala	90	38	1.2	1	— 1.4	30	—0.6	2.6
Columbia River.								
Umatilla, Oreg	270	25	9.3	1	6.7	30	7.9	2.6
The Dalles, Oreg	166	40	14.5	1	10.0	30	11.9	4.5
Willamette River.								
Albany, Oreg	99	20	2.5	1,4-7	1.4	27-30	1.9	1.1
Portland, Oreg	10	15	7.6	1	3.8	28	5.7	3.8
Sacramento River.								
Red Bluff, Cal	241	23	— 0.9	1-30	— 0.9	1-30	—0.9	0.0
Sacramento, Cal	70	25	7.8	1-5	7.6	29,30	7.7	0.2

* Distance to Gulf of Mexico.

CLIMATE AND CROP SERVICE.

By JAMES BERRY, Chief of Climate and Crop Service Division.

The following extracts relating to the general weather conditions in the several States and Territories are taken from the monthly reports of the respective sections of the Climate and Crop Service. The name of the section director is given after each summary.

Rainfall is expressed in inches.

Alabama.—The mean temperature was 72.7°, or 1.9° below normal; the highest was 104°, at Riverton on the 6th, and the lowest, 30°, at Newburg on the 28th. The average precipitation was 0.66, or 2.24 below normal; the greatest monthly amount, 2.80, occurred at Daphne, while none fell at Talladega and Warrior. The first killing frost of the season occurred in some northern counties from the 27th to the 30th, causing damage to late cotton and minor crops.—*F. P. Chaffee.*

Arizona.—The mean temperature was 80.0°, or 4.0° above normal; the highest was 118°, at Texas Hill on the 2d, and the lowest, 32°, at Snowflake on the 30th. The average precipitation was 0.80, or 0.48 below normal; the greatest monthly amount, 5.03, occurred at Pinal Ranch, while none fell at several stations.—*W. G. Burns.*

Arkansas.—The mean temperature was 71.9°, or 1.5° below normal; the highest was 109°, at Conway on the 3d, and the lowest, 28°, at Corning on the 29th. The average precipitation was 1.21, or 2.19 below normal; the greatest monthly amount, 3.00, occurred at Hot Springs, and the least, trace, at Dardanelle and Luna Landing.—*E. B. Richards.*

California.—The mean temperature for the State, obtained by weighting the reports from 295 stations, so that equal areas have about the same weight, was 70.9°, or 2.0° above normal, as determined from 208 records; the highest was 122°, at Ogilby, San Diego County, on the 12th, and the lowest, 18°, at Bodie, Mono County, on the 16th. The

average precipitation, as determined by the records of 312 stations, was 0.03; the deficiency, as indicated by reports from 216 stations, which have normals, was 0.39; the greatest monthly amount, 2.61, occurred at Crescent City, Del Norte County, while none fell at 257 stations.—*Alexander G. McAdie.*

Colorado.—The mean temperature was 60.4°, or 2.0° above normal; the highest was 106°, at Lamar on the 6th, and the lowest, 17°, at Santa Clara on the 28th. The average precipitation was 0.70, or about 0.35 below normal; the greatest monthly amount, 3.10, occurred at Santa Clara, while none fell at Holyoke and Perry Park.—*F. H. Brandenburg.*

Florida.—The mean temperature was 78.2°, or nearly normal; the highest was 97°, at several stations on different dates, and the lowest, 40°, at Wausau on the 27th and 28th. The average precipitation was 4.78, or about 2.00 below normal; the greatest monthly amount, 11.27, occurred at Jupiter, and the least, 0.14, at De Funiak Springs.—*A. J. Mitchell.*

Georgia.—The mean temperature was 73.4°, or 1.0° below normal; the highest was 102°, at Jesup on the 7th, and at Covington on the 7th and 9th, and the lowest, 34°, at Dahlonega on the 27th. The average precipitation was 1.40, or 2.15 below normal; the greatest monthly amount, 7.62, occurred at Mauzy, and the least, 0.12, at Griffin.—*J. B. Marbury.*

Idaho.—The mean temperature was 59.7°, or 3.9° above normal; the highest was 104°, at Hagerman on the 2d, and the lowest, 14°, at Chesterfield on the 8th. The average precipitation was 0.46, or 0.56 below normal; the greatest monthly amount, 2.48, occurred at Lakeview, while none fell at American Falls, Chesterfield, Downey, Gray, and Oakley.—*S. M. Blandford.*

Illinois.—The mean temperature was 65.4°, or 1.4° below normal; the highest was 106°, at Alexander on the 6th, and the lowest, 14°, at Lanark and Savanna on the 30th. The average precipitation was 2.04, or 1.28 below normal; the greatest monthly amount, 5.24, occurred at Peoria, and the least, 0.37, at Robinson. Heavy or killing frosts occurred on the 27th and freezing weather on the 29th and 30th.—*C. E. Linney.*

Indiana.—The mean temperature was 65.3°, or more than 1.0° below normal; the highest was 106°, at Washington on the 6th and at Vincennes on the 7th, and the lowest, 21°, at Prairie Creek on the 29th. The average precipitation was 1.74, or 1.28 below normal; the greatest monthly amount, 4.23, occurred at Columbia City, and the least, 0.09, at Greensburg.—*C. F. R. Wappenhans.*

Iowa.—The mean temperature was 62.5°, or 1.8° below normal; the highest was 104°, at Eldon on the 6th, and the lowest, 15°, at Sheldon, Sibley, and Mason City on the 29th and 30th. All previous September records were broken for both hot and cold weather. The average precipitation was 0.93, or 2.06 below normal; the greatest monthly amount, 4.32, occurred at Keokuk, and the least, trace, at Blockton.—*J. R. Sage, Director; G. M. Chappel, Assistant.*

Kansas.—The mean temperature was 68.8°, or nearly normal; the highest was 108°, at Phillipsburg on the 7th, and the lowest, 25°, at Lebanon on the 19th and at Fanning on the 29th. The average precipitation was 1.91, or 0.53 below normal; the greatest monthly amount, 4.75, occurred at Wichita, while none fell at Lebanon.—*T. B. Jennings.*

Kentucky.—The mean temperature was 68.7°, or 1.6° below normal; the highest was 105°, at Greensburg on the 6th, and the lowest, 27°, at St. John on the 30th. Killing frosts occurred at many places on the 30th. The average precipitation was 1.67, or 1.00 below normal; the greatest monthly amount, 4.37, occurred at Marrowbone, and the least, 0.05, at Canton.—*H. B. Hersey.*

Louisiana.—The mean temperature was 74.0°, or 2.2° below normal; the highest was 106°, at Bastrop, Liberty Hill, and Montgomery on the 5th, and the lowest, 36°, at Oakridge on the 27th. The average precipitation was 1.79, or 2.16 below normal; the greatest monthly amount, 7.96, occurred at Venice, and the least, 0.03, at Southern University Farm.—*W. T. Blythe.*

Maryland and Delaware.—The mean temperature was 65.8°, or 2.5° below normal; the highest was 99°, at Frostburg, Md., on the 3d, and at Solomons, Md., on the 6th, and the lowest, 25°, at Sunnyside, Md., on the 25th. The average precipitation was 4.34, or 1.17 above normal; the greatest monthly amount, 9.43, occurred at McDonogh, Md., and the least, 0.77, at Sandy Point, Md.—*F. J. Walz.*

Michigan.—The mean temperature was 56.9°, or 3.4° below normal; the highest was 99°, at Berrien Springs and Mottville on the 7th, and the lowest, 16°, at Thomaston on the 13th The average precipitation was 3.06, or 0.18 above normal; the greatest monthly amount, 5.83, occurred at Wetmore, and the least, 1.25, at Howell Junction.—*C. F. Schneider.*

Minnesota.—The mean temperature was 56.4°, or about 3.0° below normal; the highest was 98°, at New Ulm on the 6th, and the lowest, 13°, at Hallock on the 29th. The average precipitation was 1.47, or 0.81 below normal; the greatest monthly amount, 5.26, occurred at Willow River, and the least, 0.15, at Pleasant Mounds.—*T. S. Outram.*

Mississippi.—The mean temperature was 72.8°, or 0.8° below normal; the highest was 105°, at Jackson on the 4th and at Yazoo City on the 7th, and the lowest, 34°, at Batesville and Ripley on the 27th. The average precipitation was 1.07, or 1.44 below normal; the greatest monthly amount, 3.85, occurred at Walnut Grove, while none fell at Hernando.—*H. E. Wilkinson.*

Missouri.—The mean temperature was 67.5°, or 1.8° below normal; the highest was 108°, at Mexico on the 3d, 4th, and 5th, and the lowest, 16°, at Potosi on the 30th. The average precipitation was 2.03, or 1.57 below normal; the greatest monthly amount, 4.40, occurred at McCune Station, and the least, 0.50, at Harrisonville. Killing frost occurred at a few stations on the 26th and 27th and was general on the 29th and 30th, when ice formed in many localities.—*A. E. Hackett.*

Montana.—The mean temperature was 57.7°, or 2.5° above normal; the highest was 99°, at Ridge on the 3d, and the lowest, 21°, at Adel on the 8th and at Ekalaka on the 28th. The average precipitation was 0.72, or 0.51 below normal; the greatest monthly amount, 3.15, occurred at Kalispell, while none fell at Chinook, Glasgow, and St. Pauls.—*E. J. Glass.*

Nebraska.—The mean temperature was 64.4°, or 0.8° above normal; the highest was 108°, at Beaver City on the 4th and at Pleasanthill on the 5th, and the lowest, 17°, at Wakefield on the 29th. The average precipitation was 0.46, or 1.34 below normal; the greatest monthly amount, 1.57, occurred at Oakdale, while none fell at a number of stations in the western portion.—*G. A. Loveland.*

Nevada.—The mean temperature was 62.7°, or about 2.1° above normal; the highest was 98°, at Silver Peak on the 1st, and the lowest, 24°, at Wells on the 3d. The average precipitation was 0.37, or about normal; the greatest monthly amount, 0.40, occurred at Fenelon, while none fell at many stations.—*J. H. Smith.*

New England.—The mean temperature was 58.9°, or 1.4° below normal; the highest was 88°, at Waterbury, Conn., on the 1st and at Orono, Me., on the 18th, and the lowest, 23°, at Grafton, N. H., on the 16th and at Orono, Me., on the 24th. The average precipitation was 4.68, or 1.40 above normal; the greatest monthly amount, 9.16, occurred at Providence, R. I., and the least, 1.73, at Flagstaff, Me.—*J. W. Smith.*

New Jersey.—The mean temperature was 64.4°, or 1.4° below normal; the highest was 93°, at Bridgeton on the 6th and at Cape May C. H. on the 6th and 8th, and the lowest, 30°, at Charlotteburg on the 15th. The average precipitation was 5.88, or 1.96 above normal; the greatest monthly amount, 9.61, occurred at Flemington, and the least, 2.88, at Cape May C. H.—*E. W. McGann.*

New Mexico.—The mean temperature was 66.3°, or 0.5° above normal; the highest was 102°, at Gila on the 2d, and the lowest, 25°, at Winsors on the 30th. The average precipitation was 1.65, or 0.08 above normal; the greatest monthly amount, 4.92, occurred at Fort Union, while none fell at Hillsboro and Lordsburg.—*R. M. Hardinge.*

New York.—The mean temperature was 59.2°, or 1.5° below normal; the highest was 93°, at Penn Yan on the 3d, and the lowest, 26°, at Bolivar on the 15th, at New Lisbon and Saranac Lake on the 16th, and at Lowville on the 23d. The average precipitation was 4.46, or 0.30 above normal; the greatest monthly amount, 11.21, occurred at Schenectady, and the least, 1.45, at Binghamton.—*R. G. Allen.*

North Carolina.—The mean temperature was 69.5°, or 1.0° below normal; the highest was 106°, at Tarboro on the 6th, and the lowest, 27°, at Highlands on the 30th. The average precipitation was 2.64, or 1.71 below normal; the greatest monthly amount, 7.86, occurred at Louisburg, and the least, 0.12, at Wilmington.—*C. F. von Herrmann.*

North Dakota.—The mean temperature was 55.2°, or 1.5° below normal; the highest was 101°, at Fort Yates on the 2d, and the lowest, 11°, at Forman and Gallatin on the 29th. The average precipitation was 0.59, or 0.56 below normal; the greatest monthly amount, 1.76, occurred at Wahpeton, and the least, 0.01 at Williston.—*B. H. Bronson.*

Ohio.—The mean temperature was 64.1°, or 1.4° below normal; the highest was 107°, at Logan on the 5th, and the lowest, 26°, at Napoleon on the 30th. The average precipitation was 2.69, or 0.06 above normal; the greatest monthly amount, 5.85, occurred at McConnellsville, and the least, 0.55, at Jacksonboro.—*J. Warren Smith.*

Oklahoma.—The mean temperature was 73.0°; the highest was 105°, at Sapulpa and Hartshorn on the 5th, and at Healdton on the 6th, and the lowest, 32°, at Sac and Fox Agency and Pawhuska on the 29th. The average precipitation was 2.15; the greatest monthly amount, 6.91, occurred at Mangum, and the least, 0.05, at Muscogee.—*H. L. Ball.*

Oregon.—The mean temperature was 61.6°, the highest on record, and 3.7° above normal; the highest was 100°, at Pendleton on the 11th, and the lowest, 16°, at Riverside on the 6th. The average precipitation was 1.37, or 0.44 below normal; the greatest monthly amount, 4.63, occurred at Nehalem, while none fell at Lakeview and P. Ranch.—*B. S. Pague.*

Pennsylvania.—The mean temperature was 61.8°, or 1.8° below normal; the highest was 93°, at Derry Station on the 1st and at Coatesville on the 6th, and the lowest, 23°, at Franklin on the 30th. The average precipitation was 4.70, or 1.47 above normal; the greatest monthly amount, 9.31, occurred at Seisholtzville, and the least, 2.03, at Towanda.—*T. F. Townsend.*

South Carolina.—The mean temperature was 72.8°, or 1.4° below normal; the highest was 102°, at Yorkville on the 7th, and the lowest, 34°, at Walhalla on the 18th. The average precipitation was 2.55, or 1.86 below normal; the greatest monthly amount, 5.25, occurred at Smiths Mills, and the least, 0.55, at Anderson.—*J. W. Bauer.*

South Dakota.—The mean temperature was 59.4°, or about 1.0° below normal; the highest was 108°, at Cherry Creek (P. O. Leslie), on the 1st, and the lowest, 9°, at Watertown, on the 29th. The average precipitation was 0.52, or about 1.02 below normal; the greatest monthly amount, 2.05, occurred at Spearfish, while none fell at Canton.—*S. W. Glenn.*

Tennessee.—The mean temperature was 69.4°, or 0.7° below normal; the highest was 105°, at Pope on the 5th, and the lowest, 24°, at Erasmus on the 30th. The average precipitation was 1.48, or 1.51 below normal; the greatest monthly amount, 5.00, occurred at Greeneville, and the least, 0.23, at Sewanee.—*H. C. Bate.*

Texas.—The mean temperature, determined by comparison of 46 stations distributed throughout the State, was 0.3° below normal. Nearly normal conditions prevailed over the panhandle and along the immediate coast; there was an excess, ranging from 1.2° to 2.5°, over central and west Texas, while there was a deficiency elsewhere, with the greatest, 3.3°, at Sulphur Springs; the highest was 106°, at Paris on the 7th, and the lowest, 40°, at Jacksonville on the 27th and at Mount Blanco on the 29th. The average precipitation, determined by comparison of 53 stations distributed throughout the State, was 1.30 below normal; there was a marked excess over the panhandle and in the vicinity of Camp Eagle Pass, while there was a general deficiency elsewhere, ranging from 1.00 to 4.36, with the greatest deficit in the vicinity of Galveston. The rainfall for September was generally light and very unevenly distributed throughout the State; there was comparatively none over eastern Texas. The greatest monthly amount, 6.50, occurred at Camp Eagle Pass, while none fell at several stations.—*I. M. Cline.*

Utah.—The mean temperature was 65.3°, or 1.9° above normal; the highest was 103°, at St. George on the 1st, and the lowest, 22°, at Woodruff on the 8th. The average precipitation was 0.05, or 0.78 below normal; the greatest monthly amount, 0.70, occurred at Croydon, while none fell at many stations.—*L. H. Murdoch.*

Virginia.—The mean temperature was 67.0°, or 2.2° below normal; the highest was 100°, at several stations on the 6th, and the lowest, 22°, at Hot Springs on the 30th. The average precipitation was 3.51, or 0.09 above normal; the greatest monthly amount, 7.16, occurred at Scottsburg, and the least, 0.36, at Hampton.—*E. A. Evans.*

Washington.—The mean temperature was 61.0°, or 3.5° above normal; the highest was 98°, at Hooper on the 11th and at Centerville on the 26th, and the lowest, 27°, at Cle Elum on the 28th. The average precipitation was 1.39, or about 0.70 below normal; the greatest monthly amount, 3.40, occurred at Fort Canby, and the least, 0.13, at Cheney.—*G. N. Salisbury.*

West Virginia.—The mean temperature was 64.0°, or 1.9° below normal; the highest was 100°, at Point Pleasant on the 5th, and the lowest, 26°, at Terra Alta and Elkins on the 29th and 30th. The average precipitation was 3.65, or 1.04 above normal; the greatest monthly amount, 6.35, occurred at New Martinsville, and the least, 1.65, at Lanes Bottom.—*C. M. Strong.*

Wisconsin.—The mean temperature was 57.3°, or 3.2° below normal; the highest was 97°, at Brodhead and Sharon on the 5th, and the lowest, 11°, at Medford on the 30th. The average precipitation was 2.57, or 0.48 below normal; the greatest monthly amount, 5.92, occurred at North Crandon, and the least, 0.20, at Spooner.—*W. M. Wilson.*

Wyoming.—The mean temperature was 57.2°, or 0.5° above normal; the highest was 102°, at Fort Laramie on the 3d, and the lowest. 16°, at Burns on the 25th and 29th. The average precipitation was 0.58, or 0.25 below normal; the greatest monthly amount, 2.44, occurred at Douglas, and the least, 0.04, at Bedford, Burns, Evanston, Hyattville, and Thayne.—*W. S. Palmer.*

SPECIAL CONTRIBUTIONS.

RECENT PAPERS BEARING ON METEOROLOGY.

W. F. R. PHILLIPS, in charge of Library, etc.

The subjoined list of titles has been selected from the contents of the periodicals and serials recently arrived in the library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau:

Archives des Sciences Physiques et Naturelles. Genève. 4me série. Tome 8.
Dufour, Ch. Comparaison entre la lumière du soleil et celle de quelques étoiles. P. 209.
Meteorologische Zeitschrift. Wien. Band 16.
Polis, P. Die Strömungen der Luft in den barometrischen Minima und Maxima. P. 337.
Valentin, J. Einige Ergebnisse der Aufstiege der österreichischen Luftballons bei der internationalen Simultanfahrt am 24 März, 1899. P. 353.
—— Resultate der Meteorologischen Beobachtungen im Kondeland. P. 361.
Ferdinand, E. L. Purpurrother Regenbogen vor Sonnenaufgang. P. 365.
Czermak, P. Zur Psychrometerfrage. P. 365.
Folgheraiter, G. Ueber die Säkularvariation der magnetischen Inklination in früheren Jahrhunderten. P. 367.
Stoney, G. Die Menge des Sauerstoffs in der Atmosphäre im Vergleich zu jener in der Erdkruste. P. 371.
—— Hagel zu Madrid. P. 372.
Kutschig, E. v. Temperatur der Elbe bei Aussig. P. 372.
Hann, J. Zur Meteorologie der Küste von Senegambien. P. 373.
—— Zwei Hegelwetter. P. 376.
Trabert, Wilh. Neuere Versuche von Pellat zur Stütze der Exnerschen Theorie der Luftelektricität. P. 377.
Schmidt, A. Ueber die Ursache der Magnetischen Stürme. P. 385.
Polis, P. Die Strömungen der Luft in der barometrischen Minima und Maxima (Schluss). P. 397.
—— Die Temperaturen von Sonne und Mond. P. 412.
Hann, J. Regenfall zu Tokio. P. 417.
Do. Klima von Tucuman. P. 418.
Do. Der tägliche Gang des Barometers in Nordamerika. P. 420.
Do. Blitzphotographie. P. 422.
Hann, J. Klima von Carcarana, Argentina. P. 423.
Chabot J. J. T. Ueber die Grünstrahlung beim sogenannten Sonnenuntergang. P. 425.
—— Ausserordentliche Kälte in den Vereinigten Staaten in Februar, 1899. P. 427.
Nature. London. Vol. 60.
Stromeyer, C. E. Remarkable Lightning Flashes. P. 520.
Backhouse, T. W. Ribbon Lightning. P. 520.
Lockyer, W. J. S. Dark Lightning Flashes. P. 570.
Symon's Monthly Meteorological Magazine. London. Vol. 34.
[Symons, G. J.] Meteorological Extremes. II Temperature. P. 129.
Proceedings of American Society of Civil Engineers, New York Vol. 25.
Seddon, J. A. River Hydraulics. [Methods and results of study of data on the Mississippi and tributaries.] P. 619.
Comptes Rendus. Paris. Tome 129.
Chauveau, A. B. Sur la variation diurne de l'électricité atmosphérique. P. 500.
Poincare, A. Écarts barométriques sur le méridien du Soleil aux jours successifs de la révolution tropique de la Lune. P. 529.
Das Wetter. Berlin. 16 *Jahrgang.*
Bornstein, Prof. Dr. Ueber Witterungsdienst. [Concluded.] P. 193.
Davis, W. M. Die Cirkulation der Atmosphäre. P. 201.
—— Ueber künstliche Regenerzeugung. P. 205.
Weise. Wolkenbildung, Regen und Wald. [Continued.] P. 209.
Journal of the Franklin Institute. Philadelphia. Vol. 148.
Leduc, A. and Sacerdote, Paul. Notes on gaseous mixtures. Translated by B. F. Asherwood. (From Comptes Rendus de l'Académie, 1898. P. 218 and 338.) P. 303.
Marvin, C. F. The kite as an instrument of meteorological research. P. 241.
Quarterly Journal of the Royal Meteorological Society. London Vol. 25.
Brodie, F. J. Prolonged Deficiency of Rain in 1897 and 1898 [in England.] P. 181.
Mellish, H. Soil Temperature. P. 238.
Scientific American Supplement. New York. Vol. 48.
Bigelow, F. H. International Cloud Work of the Weather Bureau. P. 19,885.
—— Hurricane in Guadeloupe. P. 19,895.
Scientific American. New York. Vol. 81.
Bacon, J. M. Sound, Reflection and Refraction. P. 246.
National Geographic Magazine. Washington. Vol. 10.
Henry A. J. Variation in Lake Levels and Atmospheric Precipitation. P. 403.
Geographic Journal. London. Vol. 14.
Arctowski, H. The Antarctic Climate. P. 413.
Memorias de la Sociedad Científica "Antonio Alzarte." Mexico. Tome 13.
Anda, M. and Gomez, A. Le climat du Mexique en 1895 [Continued.] P. 353.

Ciel et Terre. Bruxelles. 20me Année.

Ventosa, V. La direction du vent et la scintillation. [Concluded.] P. 328.

Ridder, J. P. de. L'abeille et la pluie. P. 337.

Arctowski, H. Résultats préliminaires des observations météorologiques faites pendant l'hivernage de la *Belgica*. III Roses des vents: Phénomènes atmosphériques. P. 353.

——— Circulation de l'air dans les cyclones et les anticyclones. P. 370.

L'Aerophile. Paris. 7me année.

Besancon, G. Résultats obtenus á l'aide des ballons-sondes de MM. Hermite et Besançon. P. 99.

Proceedings of the Royal Society. London. Vol. 65.

Wilson, C. T. R. Comparative Efficiency, as Condensation nuclei, of positively and negatively charged Ions. P. 289.

OBSERVATIONS AT HONOLULU.

Through the kind cooperation of Mr. Curtis J. Lyons, Meteorologist to the Government Survey, the monthly report of meteorological conditions at Honolulu is now made partly in accordance with the new form, No. 1040, and the arrangement of the columns, therefore, differs from those previously published.

Meteorological observations at Honolulu, September, 1899.

The station is at 21° 18′ N., 157° 50′ W.

Pressure is corrected for temperature and reduced to sea level, and the gravity correction, —0.06, has been applied.

The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 12, or Beaufort scale. Two directions of wind, or values of wind force or amounts of cloudiness, connected by a dash, indicate change from one to the other.

The rainfall for twenty-four hours has always been measured at 7:30 p. m., not 1 p. m., Greenwich time, on the respective dates.

The rain gage, 8 inches in diameter, is 1 foot above ground. Thermometer, 9 feet above ground. Ground is 43 feet, and the barometer 50 feet above sea level.

Date.	Pressure at sea level.	Temperature.		During twenty-four hours preceding 1 p. m., Greenwich time, or 2:30 a. m., Honolulu time.								
				Temperature.		Means.		Wind.		Sea-level pressures.		Total rainfall at 9 a. m., local time.
		Dry bulb.	Wet bulb.	Maximum.	Minimum.	Dew-point.	Relative humidity.	Prevailing direction.	Force.	Average cloudiness.	Maximum.	Minimum.	
	*	†	†			‡	‡		§				
1	29.98	74	67	84	76	63.3	60	ne.	2-4	5	30.06	29.96	0.03
2	29.95	74	66.5	82	72	63.3	64	ne.	2-4-0	6-2	30.01	29.92	0.05
3	30.00	75	67	84	71	62.7	61	ne.	2	3	30.02	29.92	0.00
4	30.03	74	67	84	74	63.0	60	ne.	3	2	30.05	29.98	0.00
5	29.98	73	67.5	85	74	62.7	61	ne.	3	2	30.06	29.95	0.06
6	29.98	72	68	84	71	64.5	65	ne.	4	5	30.02	29.94	0.04
7	30.04	75	69	84	72	64.7	67	ne.	4	4	30.06	29.98	0.03
8	30.04	75	69	84	72	65.5	65	ne.	4	1	30.08	30.00	0.00
9	29.97	76	69	85	74	65.0	65	nne.	3	2-5	30.06	29.97	0.00
10	29.90	75	68	83	75	63.7	62	nne.	3	4-8	29.97	29.88	0.02
11	29.92	74	68.5	81	75	65.0	68	nne.	3	7-4	29.96	29.89	0.08
12	29.90	77	71.5	83	73	68.5	75	ne.	1	8	29.96	29.90	0.03
13	29.89	75	67.5	84	76	68.5	72	ne.	3	8	29.96	29.89	0.00
14	29.85	70	67.5	84	75	65.0	63	ene.	4-0	4-0-4	29.92	29.84	0.01
15	29.87	72	67	85	69	65.7	69	se-ne.	2	5	29.91	29.81	0.00
16	29.93	75	67.5	84	72	63.3	63	nne.	3-4	3	29.97	29.86	0.00
17	29.94	74	68	85	74	62.5	59	ne.	3	2	29.98	29.91	0.01
18	29.94	74	66.5	84	73	63.5	63	ne.	3	3	29.98	29.91	0.03
19	29.94	75	67.5	82	71	62.3	60	nne.	3	5	30.00	29.90	0.01
20	29.99	75	67.5	83	73	63.3	61	nne.	3	6	30.02	29.94	0.01
21	29.98	72	68.5	83	74	64.5	66	nne.	3	6	30.05	29.97	0.04
22	29.98	75	69	81	72	67.3	77	ne.	2-5	6	30.03	29.95	0.14
23	29.95	74	68	83	73	66.7	70	ne.	4	3	29.99	29.93	0.06
24	30.00	75	68.5	84	71	65.0	64	ne.	2	2-4	30.05	29.95	0.00
25	30.05	75	68	83	75	65.3	65	ne.	2	7	30.07	29.99	0.00
26	29.98	72	68	84	75	63.7	63	ne.	2-4	9	30.09	29.96	0.08
27	29.93	73	67.5	81	71	67.5	74	ne.	2	7-3	29.99	29.91	0.01
28	29.94	73	67	84	72	64.3	64	ne.	2	3	29.99	29.90	0.00
29	30.02	75	67.5	84	73	63.3	62	ene.	2	2	30.06	29.94	0.00
30	30.03	70	68.7	84	75	63.7	62	ene.	4	4	30.09	29.97	0.06
Sums.													
Means.	29.96	73.9	67.9	83.5	73.1	64.6	65.0		2.9	4.5	30.015	29.927	0.80
Departure.	0.00					—2.0	—2.0			+0.5			—1.35

Mean temperature for September, 1899 (6+2+9), +3=77.1°; normal is 77.2°.
Mean pressure for September (9+3)÷2 is 29.967; normal is 29.969.

*This pressure is as recorded at 1 p. m., Greenwich time. †These temperatures are observed at 6 a. m., local, or 4:30 p. m., Greenwich time. ‡These values are the means of (6+9+2+9)÷4. §Beaufort scale.

MEXICAN CLIMATOLOGICAL DATA.

Through the kind cooperation of Senor Manuel E. Pastrana, Director of the Central Meteorologico-Magnetic Observatory, the monthly summaries of Mexican data are now communicated in manuscript, in advance of their publication in the Boletin Mensual. An abstract, translated into English measures, is here given, in continuation of the similar tables published in the MONTHLY WEATHER REVIEW since 1896. The barometric means have not been reduced to standard gravity, but this correction will be given at some future date when the pressures are published on our Chart IV.

Mexican data for August, 1899.

Stations.	Altitude.	Mean barometer.	Temperature.			Relative humidity.	Precipitation.	Prevailing direction.	
			Max.	Min.	Mean.			Wind.	Cloud.
	Feet.	*Inch.*	°*F.*	°*F.*	°*F.*	%	*Inch.*		
Colima	.....	.....	89.6	69.8	.....	.....	.....	.....	.....
Culiacán Rosales (E. d. S.)	112	29.69	98.6	73.4	85.8	73	4.35	ne.	.....
Durango (Seminario)	6,243	24.05	91.4	56.1	72.1	55	0.79	sw.	e.
Guanajuato	6,761	23.70	82.6	55.0	66.7	62	4.98	ne.	ne.
Leon (Guanajuato)	5,934	24.30	84.4	50.4	68.4	64	2.93	se.	ne.
Mexico (Obs. Cent.)	7,472	23.06	77.9	50.0	61.9	69	5.13	nw.	ne.
Morelia (Seminario)	6,640	23.98	76.5	54.9	63.5	80	5.90	e.	e.
Puebla (Col. Cat.)	7,112	23.36	77.0	49.8	66.7	77	5.85	e.	se.
Saltillo (Col. S. Juan)	5,399	24.78	87.8	63.0	75.2	57	0.78	nnw.	ne.
San Isidro (Hac. de Guanajuato)	.....	.....	78.4	67.1	.....	.....	4.72	se.	.....
Silao	6,063	24.28	79.7	58.8	70.3	64	4.46	ene.	ese.

Mexican data for September, 1899.

Stations.	Altitude.	Mean barometer.	Temperature.			Relative humidity.	Precipitation.	Prevailing direction.	
			Max.	Min.	Mean.			Wind.	Cloud.
	Feet.	*Inch.*	°*F.*	°*F.*	°*F.*	%	*Inch.*		
Colima	1,600	28.27	93.9	63.3	77.7	76	9.51	sw.	ssw.
Culiacán Rosales (E d. S.)	112	29.71	100.8	74.7	86.5	67	2.50	ne.	.....
Leon (Guanajuato)	5,934	24.35	81.3	46.2	65.5	67	4.53	s.	e.
Mexico (Obs. Cent.)	7,472	23.10	74.1	44.6	60.1	70	6.68	n.	ne.
Morelia (Seminario)	6,401	23.98	75.2	48.9	61.7	78	6.67	se.	e.
Oaxaco	5,164	25.08	91.8	50.0	67.1	82	5.69	nw.	ne.
Puebla (Col. Cat.)	7,112	23.38	75.2	44.4	64.9	81	6.01	n.	ne.
Saltillo (Col. S. Juan)	5,399	24.86	80.6	50.0	66.7	69	4.26	n.	sw.
San Isidro (Hac. de Guanajuato)	.....	.....	75.2	64.4	.....	.....	7.72	.....	.....
Silao	6,063	24.32	76.8	54.5	68.0	62	4.65	ene.	ese.
Zapotlan (Seminario)	5,078	25.12	81.0	52.0	67.8	67	7.53	n.	se.

THE ORIGIN, PATHS, AND LIMITING ZONES OF THE TYPHOONS OF THE ORIENT.

(An address by Paul Bergholz, Director of the Meteorological Observatory at Bremen. Read before the Section of Physics and Meteorology at the seventy-first meeting of German scientists, Munich, September 19, 1899. Translated by the Editor.)

In 1897 a work was published[1] in which there is brought together and skilfully combined into a whole all the extensive material relative to the hurricanes of the Tropics that had, up to that time, been collected by the observatories at Hongkong, Tokio, Manila, and Shanghai. Especially numerous are the observations collected in Manila, because there is scarcely a single large atmospheric disturbance that develops in the waters of the Orient that does not make itself felt in the Philippines. Scattered through the book, as was appropriate since it had a purely practical object, are some general considerations relative to the origin, the paths, and the zones of hurricanes. We will at present examine these views more closely but, of course, can not reproduce the extensive tabular material.[2]

[1] Baguios ó Ciclones Filipinos. Estudio Téorico-Practicó por el P. José Algué, S. J., Director del Observatorio. Manila, 1897.

[2] Compare Bergholz, "Die Orkane des Fernen Ostens." Max Nössler, Bremen und Shanghai, 1899.

According to Viñes the cyclone regions of the Tropics harmonize in a more or less perfect manner with the following geographical sketch:

In the West they occur on the open sea and on continents or islands that are rich in indentations and bays, whose coasts trend in general north and south; in the East they occur over broad extensive oceans that are strewn with islands.

These conditions are more or less perfectly fulfilled in the cyclone regions of Central America, the Philippines and the China Sea, the Indian Ocean, and, in the Southern Hemisphere, the cyclone regions of southern Africa, with the neighboring islands of Madagascar, Mauritius, Rodriguez, etc. These regions do not offer equally favorable conditions for the formation of cyclones in every season of the year.

In order to trace the hurricanes of eastern Asia back to their initial conditions, observations must be obtained from the Caroline Islands, the Marianna Islands, and the portions of the ocean lying east of Mindanao, but such observations were first made in sufficient numbers in recent years.

If we group the paths of the better known hurricanes since 1878, according to months, we recognize not only the tropical origin, but also that the hurricanes of individual monthly groups have much similarity in their paths and their initial conditions. We can, indeed, not draw very sharp division lines, because the hurricanes of neighboring months, for instance, September and October, must be almost identical in their paths and their origins. If, however, we keep this in mind in the respective cases, we may divide the hurricanes into three groups of months, the first of which extends from December to March, inclusive, the second includes April and May, October and November; the third includes the remaining months of the year, viz, June, July, August, and September. The place of origin of by far the largest number of all tropical cyclones lies east of the Philippines; many are formed south of latitude 10° N., but none are formed north of 20° N.

In the first group, the larger number of the hurricanes originate in latitudes lower than 10° N., and only in the beginning of December and the beginning of March are they formed somewhat farther to the north; therefore, for this group the starting points are located between latitudes 5° N. and 12° N., and longitudes 145 E. and 143° E.

In the second group, the region of formation of cyclones extends from 147° E. to 129° E.

In the third group, the limits of this region are 20° N. and 8° N., and 139° and 126° E.

If we consult the charts of isobars and isotherms that are given in the Boletin Mensual of the Manila Observatory for 1894, we find that in the first group the starting points of the hurricanes lie between the isobars 757 and 759 mm., and between the isotherms 27° and 30° C. For the second group the origins lie between the same isobars and the isotherms 28° and 30°. In September the origins lie on the isobar 757 mm., but in the remaining months of the third group, between 757 and 759 mm. In all the months of this group they lie between the isotherms 28° and 29° C.

It follows that hurricanes are formed in regions within which neither the barometric nor the thermometric gradient has any notable value, and therefore in a sort of neutral zone.

From February to July and August the origins move toward the north-northwest, and then, until January, backward toward the south-southeast. These movements show a connection between the declination of the sun and the origin of a cyclone.

The paths of the tropical hurricanes of eastern Asia can be classified into two great divisions, those of the Pacific Ocean and those of the China Sea. The former do not intersect the meridian 130° E., but the hurricanes of the China Sea do intersect this meridian, or even sometimes are formed in the China Sea itself.

TYPHOONS OF THE PACIFIC OCEAN.

The following table shows at a glance our classification of the hurricanes of the Pacific Ocean:

Typhoons of the Pacific Ocean.

Group.	Months.	Trend of first branch.*	Latitude of vertex of parabola.	Trend of second branch.
1	December, January, February, March	North-northwest	15°–19°	North-northeast.
2	April, May, October, November	Northwest	16°–21°	Northeast.
3	June, July, August, September	Northwest by north.	21°–25°	Northeast by east.

* Namely, when passing the small circle of latitude for Manila.

In general, the paths of these hurricanes are all parabolic. The average trend of the paths or the inclination to the meridian is much larger when they pass the latitude of Manila (14° 35′ N.) than the average trend in the first branch. This is particularly noticeable during the months of the first group, and this evidently results from the fact that the latitude of the intersection [vertex?] of the path agrees very nearly with the latitude of Manila.

TYPHOONS OF THE CHINA SEA.

Not a single one of the hurricanes that occur in the months belonging to the first group turn backward or have a parabolic path. However, it is possible that occasionally these cyclones recurve in the interior of the Continent of Asia, but observations on this point are still wanting.

Some of the hurricanes of the second group have a parabolic path. These turn back in the China Sea south of the Formosa Channel. Since, however, the first branch of such a path inclines northward less than is the case with the hurricanes of the Pacific Ocean, therefore its recurvature is completed in lower latitudes than by those hurricanes.

The hurricanes that belong to the typhoon months, properly so called, or to the third group, recurve much more frequently than the others. They also attain much higher latitudes. The recurving hurricanes of this third group are very similar in their properties to the hurricanes of the Pacific Ocean proper. If we follow the course of the paths of those hurricanes of the China Sea that do not recurve, there results:

1. The hurricanes that are formed in the months of December to March have, from the beginning, a motion in the direction west by north, which they retain through their whole course over the southern portion of the China Sea. In December and January they reach the Asiatic Continent in French Cochin China and the southern coast of Anam; those of February and March arrive somewhat farther to the north, almost exclusively in Anam. The origin of these hurricanes is between latitudes 5° and 12° N., but they arrive on these coasts between 8° and 15° N. This defines the zone of these hurricanes.

2. The hurricanes of April and May pursue a direction toward the northwest by west; in April they arrive in northern Anam, in May in the Gulf of Tonquin (Tong-King) and the Straits of Hainan, but at the end of May they reach the region of Macao (22° N.). The October cyclones, which pursue a west-northwest course, reach the Continent of Asia in the

first part of the month, as far north as Hongkong (22° N.), but later in the month they arrive farther south, namely, in the Gulf of Tonquin. In November the trend of the hurricane has again become west by north and again they strike the coast of Anam. The origin of this group of hurricanes lies between latitude 6° and 17° N., and they strike the coast between latitude 12° and 23°.

3. The June hurricanes of the third group, having a northwesterly movement, pass between "Breaker Point" (N. 23°, E. 117°) and the Straits of Hainan (N. 20.2°, E. 110.5°), on the south coast of China. Some of them curve backward in the southern portion of Formosa Straits.

4. The July typhoons which, at the beginning, also take a northwest course, can be divided into three classes. Those of the first class move like those of June; those of the second class arrive on the Chinese coast between Amoy (24° N.) and Shanghai (31.3° N.) or curve backward and pass over the Yellow Sea in a north-northeast direction; those of the third class finally recurve opposite Formosa (23.5° N.) and pass over the Sea of Japan.

5. In August the original movements of the cyclones still remain toward the northwest, and in other respects they behave the same as those of July. The September hurricanes move at first toward northwest by west., but in other respects behave like the first and third classes of the July hurricanes.

6. For the hurricanes of the months of the third group (June–September) the zone extends from their place of origin, between latitudes 8° and 20°, to their place of arrival on the Continent of Asia, between the parallels 30° N. and 18° N.

If now, with the assistance of the charts of isobars, we determine the conditions under which the cyclones are formed in the different months and groups of months, we find:

(*a*) The paths of the hurricanes of the Pacific Ocean in the first group start from the region between two areas of high pressure, one of which lies over the continent, the other over the Pacific Ocean. They lead toward the center of low pressure that occupies a portion of Bering Sea. The hurricanes of the China Sea keep within lower latitudes, namely, those which are reached by the limiting isobars of the Asiatic center of high pressure. In proportion as the centers of high pressure flatten out and withdraw during the period from January to March, so these extreme isobars retreat toward the north, and consequently the paths of the hurricanes extend farther north.

(*b*) With reference to the second group, the charts of monthly isobars show that the hurricanes of the Pacific Ocean in April and May move between the extreme isobars of the high pressure areas of the Pacific Ocean and Asia.

(*c*) The paths of the hurricanes of the China Sea keep south of the isobar 760 mm., belonging to the high pressure area of Asia and the low pressure area of Hindostan. In October and November, in proportion as the Asiatic high pressure area develops, these are pushed more and more into lower latitudes; moreover, the development of the area of low pressure in Hindostan is an index to these paths.

(*d*) The hurricanes of the Pacific Ocean, especially in October, pass along the broad zone between the Philippines and Japan, on the one hand, and the isobar of 760 mm. surrounding the high pressure area of the Pacific. In November this zone becomes narrower by reason of the further development of the continental area of high pressure. The hurricanes of the Pacific Ocean belonging to this group also pursue paths toward the depression in the extreme north, which bears north-northeast from Manila.

(*e*) It is characteristic for the months of the third group that from June to September, at least to the middle of the latter month, the center of high pressure withdraws from the coast of Asia, and finally disappears. In connection with this the paths of the hurricanes attain higher latitudes, and those of the Pacific Ocean recurve very near the meridian of 125° east, therefore nearer to the Philippines than in the previous months. A single exception offers in the case of the hurricanes of the second half of September, whose recurving points are from 5° to 8° farther east. All hurricanes in the Pacific Ocean have as their ultimate destination the northern center of low pressure. The paths of the hurricanes of the China Sea trend more toward the north in proportion as the high pressure area of the continent moves northward, and do this, therefore, up to the end of August and the beginning of September; if, however, the low pressure area moves toward the south about the beginning of September, then also the paths of these cyclones must follow it. Some of the July hurricanes after recurving follow paths going very nearly northward; they cross over the Yellow Sea and travel toward a small center of low pressure that has developed in Siberia.

THE INTERNATIONAL CLOUD WORK OF THE WEATHER BUREAU.[1]

By FRANK H. BIGELOW, Professor of Meteorology, U. S. Weather Bureau.

In the month of May, 1896, several national meteorological services began in cooperation to take a series of simultaneous observations on the height and the motion of the ten standard types of clouds which have been defined by the International Committee. The object of this survey of the movements of the atmosphere, continued for at least one year, was to gather material that could be used to determine the action of the higher strata with reference to the formation and the progressive motion of storms. Our observations are generally so exclusively made in the lowest level of the ocean of air that comparatively imperfect information exists regarding the higher currents upon which to found intelligent theories, and it is with the purpose of supplying this deficiency that the series of international observations was undertaken. By the liberal policy of the United States Government, the Weather Bureau was able to do its part of the work. The discussion of the data is now finished for the report which it is expected to issue by the end of the present year. While it is not practicable to give any detailed account of the results, it may be interesting to present a brief synopsis of the scope of the report now being prepared by the writer.

The observations are divided into two classes: (1) The primary, which are made by means of two theodolites placed at the end of a long base line adapted to triangulations in the vertical direction. These give the absolute height, velocity, and direction of motion of individual clouds; between 6,000 and 7,000 of such observations were made at Washington, D. C. (2) The secondary, executed with nephoscopes at 14 stations distributed at nearly equal distances from each other over the districts east of the Rocky Mountains, give the relative velocity and direction of motion, and with the help of the results obtained by the primary system can be translated into absolute values; there were 25,000 to 30,000 of these observations made in the United States.

The discussion of these data has been divided into a number of parts, of which the following may be mentioned in this connection:

1. The distribution of the cirrus, cirro-stratus, cirro-cumulus, alto-cumulus, alto-stratus, strato-cumulus, cumulo-nim-

[1] The important work on which Professor Bigelow has been engaged for several years is now completed and about to be published in the Annual Report for 1898–99. Meantime, our readers will be glad to obtain a comprehensive statement as to the nature of the work; we therefore reprint the accompanying article from the National Geographic Magazine for September, 1899.

bus, nimbus, cumulus, stratus, was so determined that we now know the average height of each type for every month in the year, and the depth of the zone or horizontal belt in which they may severally occur. Thus the upper types are found in layers as much as 6 miles thick, though they form most frequently near the middle of their respective belts; the lower are thinner, and have some peculiar characteristics besides. When we consider that the height and shape of these belts, changing from month to month, indicates some very delicate physical process going on in the aqueous vapor of the atmosphere, it is easy to see that they become the best means for studying the state of the pressure, temperature, and vapor tension—that is, the physics of the air itself.

2. A very important subject has been the determination of the direction and velocities of the horizontal motions of the air in each of the eight principal levels, on all sides of the anti-cyclones and cyclones, high and low areas of pressure, as they move over this country. These movements have been separated into two components, the first belonging to the general or undisturbed motion of the atmosphere, which is about eastward in this latitude, and the second pertaining to the local motions, which are gyratory, and especially concerned with the descending and ascending vortices or storms. This data gives us for the first time definite information regarding storm components, and these enable us to look into the theories much more closely than heretofore.

3. This analysis has been supplemented by a compilation of cloud motions taking place in the cumulus or the cirrus levels, as derived from the Weather Bureau cloud charts collected during the past twenty years, the object of which is to show how the average anticyclone and cyclone are affected by the circulation of the air over different parts of the United States—that is, by the Rocky Mountains, the Lake region, the Gulf of Mexico, and the Atlantic Ocean — the results being exhibited on a series of colored charts.

These practical facts lead to the necessity of definite theoretical studies in order to account for them, and this again to several other lines of research:

1. The first step was to prepare a system of standard constants and formulæ by a comparative study of the papers of several authors, and by the addition of such new demonstrations as seemed desirable, so that the work of many men in their several branches may be read as one consistent meteorological scheme. This standard system represents the outcome of several years' study of the subject. These formulæ include most of the thermodynamic or hydrodynamic conditions likely to arise on a rotating body surrounded by an atmosphere, like the earth.

2. Next, a completely new set of working tables, based upon these formulæ, has been prepared for the barometric reductions from one level to another; for studying with the greatest accuracy the exact conditions of pressure, temperature and vapor tension at the level where a cumulus cloud base forms by the vertical convection, at the place where the hail forms, and at the level where the snow is produced; and finally for computing the dynamic forces and the gradients of motion according to the observed velocities. These tables are permanently useful to meteorology, and that they are needed is seen from the following considerations: (*a*) The Smithsonian tables and the International tables are adapted for the reduction from elevations 2,000 meters or less to the sea level; but in cloud work it is necessary to reduce at will throughout a region up to 15,000 meters in height and with ranges of temperature from +30° to −60° C., which is far beyond the limits of any existing tables. (*b*) The Hertz diagram for adiabatic expansion leaves out the vapor contents of the air in parts of the formulæ, introducing errors of as much as 0.30 inch in pressure. Besides, it is desirable to be able to start with surface conditions and compute upward in exact figures all the elements existing in the cloud, and also the gradients connecting one level with another. (*c*) Since the atmosphere differs very widely from the adiabatic laws, one of our problems is to discuss how large this departure is for all seasons of the year, and from this data we expect to study carefully the laws of solar insolation and terrestrial radiation—that is, the actinometry of the atmosphere—by means of the new and improved material. (*d*) Finally, there are no tables published which are available for computing the dynamic forces indicated by the equations, and these are necessary if meteorology is to be made an exact science.

3. The possession of all this new matter enables us to analyze closely the Ferrel theory of the local cyclone and the German theory of the same, which differ from each other, and to show that they are both only ideal solutions of vortices, and do not conform to the stream lines given by the observations. An attempt has been made to interpret the analytical equations of motion, so that they shall match the observed facts, and this leads to a different idea of the circulation in storms from that commonly taught by meteorologists. The application of the theory to tornadoes is certainly satisfactory, and in the case of hurricanes and cyclones it is on the whole very promising.

FLOODS AND FLOOD PROBLEMS.[1]

By H. C. FRANKENFIELD, Forecast Official, U. S. Weather Bureau, Washington, D. C.

You have discussed, or will discuss, many methods for the improvement of commerce, and the consequent increase of wealth to the country. Of equal importance is the discussion of ways and means looking toward the prevention of loss and damage, and the consequent diminution of wealth, the effect of which would be far-reaching. To this latter branch of your work I have been directed by the Chief of the Weather Bureau to contribute, and I will endeavor to do so by presenting for your consideration a paper on "Floods and Flood Problems of the Mississippi River." About 40 per cent of the entire population of the United States live within the watershed of the Mississippi River, the basin comprising about two-fifths of the total area of the United States; and I therefore submit that any information, however slight, which will contribute to the material welfare of a very considerable portion of this district is worthy of proper consideration.

It may be of interest, by way of preface, to make some brief historical mention of the great floods of the Mississippi system. Nothing except comparatively faint tradition exists regarding the floods preceding those of the present century. In April, 1785, the Mississippi River at St. Louis was said to have reached a stage of 42 feet, or 0.6 feet higher than the well-authenticated stage of June 27, 1844. You all remember the destruction that was wrought by the flood of 1892 in the vicinity of St. Louis. Yet the highest stage reached by the waters in that year was only 36 feet. Conceive, if you can, what would have happened had an additional 6 feet of water been added to the flood volume.

Since the commencement of the present century the notable flood years were 1815, 28, 44, 49, 50, 51, 58, 59, 62, 65, 67, 74, 82, 84, 90, 92, 93, and 97.

Of these the floods previous to that of 1874, while entirely authentic as to occurrence, are not equally so as regards the exact stages of water reached, with the exception of that of 1858, which was the subject of careful and accurate measurement. This lack of exactness was due to the absence of regular

[1]An address delivered at the Tenth Annual Transmississippi Commercial Congress, at Wichita, Kans., May 31, 1899.

gage readings which could be referred to a definite standard. Since 1867, however, there have been abundant gage readings, and, as a result, the flood stages are much more comparable, both as to volume and effect. Still, making due allowance for possible errors and deficient records, there is no doubt that the flood of 1844 was the greatest ever known in the upper Mississippi basin, while that of 1897, as a whole, was the greatest ever known south of the mouth of the Ohio River. From the best obtainable information the highest water of which there is reliable record occurred at the principal cities in the Mississippi basin as follows:

Station.	Stage.	Date.
	Feet.	
St. Paul, Minn.	19.7	April 29, 1881.
Omaha, Neb.	23.8	April 24, 1881.
Kansas City, Mo.	24.9	May 21, 1892.
St. Louis, Mo.	41.4	June 27, 1844.
Cincinnati, Ohio	71.1	February 14, 1884.
Cairo, Ill.	52.2	February 27, 1883.
Memphis, Tenn.	37.1	March 19-21, 1897.
Vicksburg, Miss.	52.3	April 16, 1897.
New Orleans, La.	19.5	May 13, 1897.

There is a tradition that a stage of 37 feet was reached at Kansas City, on June 20, 1844. I can not conceive of such an immense volume of water at this place; but as there is a tradition of similar stages at the same time along that portion of the Missouri River east of Kansas City, it is probably not far from being correct.

The flood question may be resolved into two general divisions, cause and remedy; both admitting of subdivision into various parts, each contributing to a greater or less extent toward the effectiveness of the whole.

The cause of floods is of course the precipitation which occurs over the basins of the rivers affected. Of the total amount of water which falls, a portion flows off into rivulets, drains, and small tributaries, finally reaching the main river. The remainder sinks into the soil, is absorbed by vegetation, or else is evaporated. The proportion of rainfall which reaches the main rivers depends upon the condition of the soil and the steepness of the slopes. Where the soil is very dry and absorptive, as in the upper Missouri Valley, nearly all of the water will be absorbed, comparatively little reaching the main river. In the bottoms of the lower Mississippi, however, where the soil is almost completely saturated with moisture, and where the rainfall is excessive, a very large proportion of the water will be discharged into the river.

The steepness of the slope of the river basins also exercises an important bearing upon the amount of water which reaches the main streams, Where the fall is comparatively steep. a much greater quantity of water will run down to the river than if the slope were gentle, the rapidity of movement preventing much absorption by the soil.

Contrary to the impression obtaining among most people, the melting snows in the mountains contribute but little to the floods of the Mississippi. As a matter of fact, nearly all of the floods come at a season when the flow from the mountains is very small. Colonel Chittenden, of the Corps of Engineers, U. S. A., in his report on Reservoir Sites in Wyoming and Colorado, says that in the greatest known flood of the Mississippi at St. Louis, that of 1844, a large part of which came from the Missouri, the latter stream was at low water stage at Sioux City, and that during the flood of 1897 neither the Arkansas nor the Platte rivers contributed any appreciable amount of water from their western portions, and that the upper Missouri and Yellowstone were both at low water stage.

The floods of the Mississippi above the mouth of the Ohio are neither so frequent, nor so extensive, nor so prolonged as they are below. Their sources of supply are fewer and smaller and the rainfall is not so abundant. From the mouth of the Missouri to the mouth of the Ohio the waters of the former are the decisive factors in flood production, and there can be no flood south of Alton, Ill., unless the Missouri east of Kansas City is in flood at the same time. A few figures will suffice to prove this. If the Mississippi at Grafton, Ill., is discharging 450,000 cubic feet of water per second, corresponding to a stage of 28 feet, or 5 feet above the danger line, and the Missouri at St. Charles, Mo., is discharging 375,000 cubic feet per second, corresponding to a stage of about 25.5 feet, or about 6 feet above the danger line, the combined discharges, 450,000+375,000, or 825,000 cubic feet, must be the amount of water that passes St. Louis every second, there being no intervening tributaries. This corresponds to a stage of about 34 feet, or only about 4 feet above the normal danger line, and supposes that both the Missouri and Mississippi are in flood. Now suppose the discharge at St. Charles, Mo., to be decreased to 175,000 cubic feet per second, corresponding to the danger line stage of 20 feet, still comparatively high, while that at Grafton, Ill., remains at 450,000 cubic feet. The total discharge will be 450,000+175,000, or 625,000 feet per second for the St. Louis gage. This corresponds to a stage of about 29.5 feet, or 0.5 foot below the danger line. On the other hand, it is possible to have a moderate flood from Alton to Cairo, Ill., while the Mississippi above the former place is at a medium stage. It is estimated that in times of flood about 70 per cent of the water which passes St. Louis, comes out of the Missouri River.

But the floods of the upper Mississippi are rarely extremely destructive, and at St. Louis improvements of such a character have been made since the flood of 1892 that less damage would be caused by a 36-foot stage, or 6 feet above the technical danger line, than would have resulted from a 32-foot stage at that time. It is only below Cairo, Ill., that the floods become such potent factors for evil, and thrust themselves into the foreground as one of the great economic problems which confront the business life of the country.

By far the most important source of these lower Mississippi floods is the immense volume of water which flows out of the Ohio River with its numerous, and extensive, and swift-flowing mountain tributaries on the south, and the slower-running and less important ones on the north. During the flood of 1897, when on March 26, the water at Cairo, Ill., reached its crest stage of 51.6 feet, the discharge of water was about 1,650,000 cubic feet per second, while at Helena, Ark., with a maximum stage of 51.3 feet on April 4, it was about 1,750,000 cubic feet per second. This is about 150,000 or 200,000 more cubic feet than finally passed Vicksburg and New Orleans, and the difference may be taken to fairly represent the amount of overflow, after deducting a slight portion due to loss by evaporation and other less important causes. This overflow is either distributed among the open swamps or bayous, or runs into the Yazoo and Red rivers as back water, or last, but unfortunately not least, breaks through levees or rushes over banks, causing the widespread ruin and disaster with which many of you are familiar. I quote in this connection from Prof. Park Morrill's exhaustive work on Floods of the Mississippi River, which was issued by the Weather Bureau after the great flood of 1897, he says:

> It is, of course, conceivable that a flood should occur in the lower Mississippi from heavy precipitation over any of the great contributory basins. In these floods of the past quarter century we do not, however, find the western tributaries playing an important part. The great source of floods is the Ohio basin, with its steep slopes from the crest of the Alleghenies, upon which fall the heaviest rains of spring at a time when the normal rise of the lower Mississippi brings the river almost to the danger line from Cairo to the Gulf. In the greatest floods we also find that heavy rainfall over the great swamp region, that extends along the Mississippi from the mouth of the Ohio to the Gulf of Mexico, is an important factor. Third in importance as a factor in producing floods is the upper Mississippi, which, while never discharging a volume sufficient to produce of itself a flood, yet, rising later than the Ohio, serves to prolong the high water, and thus to increase the overflow.

It is well that even at times of greatest floods there are ameliorating circumstances. Otherwise there would be no recovery from the enormous losses which would inevitably ensue. Over most of the districts liable to overflow the drainage is excellent; the slope is away from the river, and the water does not spread rapidly. There is plenty of time to save life, remove portable property, and take all necessary precautions. Consequently the loss, beyond the interruption to business, is confined to the destruction of crops, buildings, fences, etc.

The flood of 1897, the greatest of lower Mississippi floods of which there is authentic record, with the possible exception of that of 1882, may be said to have owed its origin to the heavy rains of January of that year in the Mississippi and extreme lower Missouri valleys, causing the rivers to rise somewhat higher than the usual midwinter stages. These conditions were much intensified by a continuation during February, of the excessive rains over the lower Mississippi valley, and their extension through the Ohio Valley and its entire tributary country. Flood stages resulted from these downpours, and the Ohio at Cincinnati reached a stage of 61.1 feet on the 26th, and at Cairo of 40.0 feet on the 28th. Meanwhile the entire Mississippi was rising rapidly. It remained for the precipitation of March to complete the work so well begun, and an inspection of the rain chart for that month will show you how completely and effectually it was enabled to do so. From this time on the flood occurrences are matters of history familiar to all of you.

The function of the Weather Bureau in times of flood is limited to the issuance of the necessary warnings a sufficient time in advance, to afford opportunity to remove all portable property to places of security, and to make the best possible disposition of that which cannot be moved. This involves extremely accurate forecasting of the stages which will be reached at each place, and the times when they will occur. It necessitates an intimate acquaintance with the entire river regime, the effects of local and general rainfalls, tributary streams, drainage basins, and levees, and also requires rapidity and accuracy of judgment when sudden changes are impending by reason of crevasses, etc. At such times the weight of responsibility resting upon the shoulders of the forecasters is tremendous, as a single error might result in enormous loss of life and property. I believe I may safely say that the work of the Weather Bureau during this flood was well performed. The warnings issued were so complete and far reaching as to cause criticism in some quarters that the Bureau was needlessly alarming the people of the threatened districts. The criticisms were unfounded, however, as the warnings were fully justified by the events.

About 13,500 square miles of land were overflowed, and portable property to the value of $15,000,000 removed to places of safety, mostly as a result of the Weather Bureau warnings. The total expense of the River and Flood Service of the whole United States for the entire year of 1897 was about $15,000. Compare this insignificant sum with the value of the property saved. As a business proposition does it not commend itself to you? Can you imagine a better return for an investment?

With a full realization of the fact that the floods must come, and that they must cause an immense amount of damage, which, under present conditions, can not be avoided, let us now pass to the second phase of the flood question, namely the remedy. Is there a remedy? There are said to be several, and each and all have been discussed *verbatim et literatim et seriatim*. In general, however, there are the advocates of the all levee system, those of the no levee system, and those who believe in the use of both levees and reservoir basins, the character of protection depending upon the topographical conditions. All, however, except a few old line extremists, are united in support of the levee system in some form, their differences being mainly of degree only.

The first query which naturally arises is, Is the levee system effective? If so, is it sufficiently effective to warrant the continued expenditure of money at the present rate to keep it so? And, if so, will it remain at its present state of efficiency without additions, and with only those repairs which are necessitated by crevasses and the natural wear and tear incident to age?

The second query which presents itself is—If the levee system is not effective, can it be made so by the expenditure of any sum of money within reason? If not, what remedy can be offered, which, while preventing flooding of the farms and plantations, will at the same time have a due regard for the interests of navigation?

In answer to the first question it must be admitted that the levee system *is* effective if the levees are properly constructed. That is, it is effective now, but along the lower Mississippi it is questionable whether it will remain so in future floods. Why, I will endeavor to explain later.

Taking the levees as they stood in 1897, I think I am correct in saying that many of those which failed to withstand the flood of that year were admittedly not as well constructed as they might have been. No criticisms of methods is implied in this statement, for it is not in the least to be doubted that the broken levees were built as substantially as was possible under the existing circumstances. The supply of funds for levee construction was limited, and had to be distributed over too large a territory. The United States Government levees were built according to a certain standard and with more ample funds, and, as far as I have been able to learn, no Government levee gave way to any extent in 1897.

As the floods above Cairo, Ill., are of minor importance on account of their comparatively infrequent occurrence and limited extent, so also is that of flood protection over the same district. Nevertheless, what could be done has been done, or shortly will be, and it has been done effectively. From St. Paul to the mouth of the Missouri River, a distance of about 700 miles, there are subject to overflow at times of high water 564,200 acres of land, or about 882 square miles, of which over one-eighth lies within the last 50 miles, between Cap Au Gris, Mo., and the mouth of the Missouri River. From Keithsburg, Ill., to Burlington, Iowa, a distance of a little over 25 miles, there is the Flint Creek levee on the Iowa side which protects 44,000 acres of land. From Warsaw, Ill., to Hamburg, Ill., a distance of about 110 miles, there are the Warsaw and Sny levees, with the exception of a gap of less than 20 miles between Quincy, Iowa, and Hannibal, Mo., which is in course of construction. These two latter levees protect 210,000 acres of the finest farm land in the world, making a total of 254,000 acres, or about 397 square miles, which are now protected, or nearly one-half as much as is now subject to overflow. When the new levees are built where needed from Burlington, Iowa, to Hannibal, Mo., the total area liable to overflow will be reduced decidedly, but exactly to what extent I am unable to say.

I am informed that the building of the levees has raised the value of the lands protected $5 per acre in some localities and $25 or even more in others. This shows that the money expended in levee building has been well applied, and that the levee system in this district is effective. It can be kept so, and will remain at its present state of efficiency with only a moderate outlay each year for repairs. The all levee system meets with unanimous approval, and more levees are wanted.

Below Cairo, Ill., however, where the greatest interests are at stake, opinions differ radically, and it becomes an extremely difficult matter to determine exactly what is the true solution of the problem. It has been charged by the enemies of the all levee system that millions of dollars have been squandered in attempts to build levees that will not withstand

flood waters, and that it is impossible to build levees that will suffice for the combination of waters such as is possible. Another class goes to the opposite extreme and asks for the old system when the surplus waters ran into the large drainage basins, the bayous, and the sloughs, overflowing millions of acres of land which are now reclaimed, at least partially, and finally finding its way back into the main channel, thereby greatly prolonging the flood period.

Between these two antipodal opinions some middle ground must be found which will afford the greatest possible measure of protection at a not too impossible cost.

The plan of reversion to the old open basin and bayou drainage can be dismissed without a word as being alike uncharitable and unworthy of this age and time, and also impossible from a social and economic point of view.

The all levee plan, that of closing all the basins and compelling the river to run between well defined banks from Cairo, Ill., to the passes, sounds very plausible, and indeed is so as far as the possibility of construction is concerned. The levees would have to be raised higher all along the line, as the narrowing of the channel would increase the height of the flood levels, but the work could be done. According to competent authority a grand chain of levees sufficient to keep out any flood could be built from Cairo to the Gulf of Mexico for about $20,000,000, to which must be added an annual charge for repairs of at least 10 per cent, and probably more. It is also probable that difficulties, at present unforeseen, would increase the original cost to an amount in the neighborhood of $25,000,000, with the same percentage for annual repairs. Even then, according to some authorities, the desired goal would not be reached. The constantly caving banks, amounting in some places to one foot a day, or 365 feet in a single year, deposit an immense amount of earth in the river, and a great quantity of it remains, gradually bringing up the bed of the river, so that, with the levee system complete, each flood would require a smaller volume of water to produce the same effects as the preceding one. Therefore, to render the all levee system perfectly effective, in addition to the building of the levees the banks on both sides of the river must be protected by revetments, and this work is extremely expensive. The revetments would cost about $100,000,000, and I have heard estimates as high as $175,000,000. Assuming the former figures to be correct, and adding to the $100,000,000 the $20,000,000 for the proposed new levees, and we have $120,000,000 as the cost of the completed work, to which must be added several millions more each year for repairs.

The power of a levee to effect the stage of the water is excellently shown in the following statement, relative to the effect of the new St. Francis levee upon the flood of 1897, by Mr. S. C. Emery, the official in charge of the Weather Bureau office at Memphis, Tenn., which was published in Professor Morrill's work on the Floods of the Mississippi River. Mr. Emery says:

> Before comparisons can be made between the present flood and those which have occurred in former years, it is necessary to take into account the changed conditions which have resulted from the construction of the Arkansas levees. Since 1890 there has been built a line of levee along the west bank of the Mississippi River, extending from Point Pleasant, Mo., south to Pecan Point, a distance of 125 miles. The purpose of the levee is to protect the St. Francis bottoms, the greater portion of which was formerly subject to an annual overflow. Of this bottom much is not under cultivation, considerable areas being covered by a succession of swamps and lakes, having a heavy growth of gum, sycamore, and cypress trees. In former years the bottom had been flooded more or less whenever the Mississippi at Cairo reached a 41 or 42-foot stage. The water after leaving the main river passed into the St. Francis basin, through which run the Little and St. Francis rivers; through these channels it again found its way to the Mississippi at a point about 12 miles north of Helena, Ark. The effect of leveeing the west bank of the Mississippi in front of the St. Francis bottom is to compel the water to pass down the Mississippi from Cairo to Helena.
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> In the following table a comparison is made of several earlier floods with that of this year. The floods occurring from 1882 to 1886 reached about the same stage at Cairo as the flood of this year. The maximum stages at Cairo, Fulton, Memphis, and Helena, during the floods of 1882–1886, together with their mean, and the corresponding stages of this year's flood, are presented.

Year.	Cairo, Ill.	Fulton, Mo.		Memphis, Tenn.		Helena, Ark.	
	Maximum stage.	Maximum stage.	Below stage at Cairo.	Maximum stage.	Below stage at Cairo.	Maximum stage.	Below stage at Cairo.
1882	51.8	36.7	15.1	35.0	16.8	47.2	4.6
1883	52.2	36.3	15.9	34.8	17.4	46.9	5.3
1884	51.8	35.7	16.1	34.2	17.6	47.0	4.8
1886	51.0	35.4	15.6	34.8	16.2	48.1	2.9
Mean	51.7	36.0	15.7	34.7	17.0	47.3	4.4
1897	51.6	37.4	14.2	37.1	14.5	51.8	0.2*

* Above.

The average difference in stage in the earlier floods between Cairo and Fulton was 15.7 feet; between Cairo and Memphis, 17.0 feet; and between Cairo and Helena, 4.4 feet. The building of the levee has caused a decrease in the difference between these points; that is, it has raised the stage at Memphis about 2.5 feet above what it would have been had the water been left to flow over the lowlands of Arkansas. So, instead of a difference of 17.0 feet between the Cairo and Memphis stages, we now have about 14.5 feet, and, had it not been for the breaking of the levee, it is probable that this difference would have been lessened at least an additional foot. In other words, the levees, if kept intact, would result in some 3 feet more water at Memphis than under former conditions. At Helena the change is still more marked, and the former difference of 4 feet has entirely disappeared, and, had it not been for the great crevasse at Flower Lake, the Helena flood crest would have been considerably above that at Cairo.

Another proposed plan of relief is to select some large basin of sufficient area as a reservoir to hold the surplus flood waters, thereby admitting of levees of more moderate heights, and at the same time conserving the surplus waters until such time as they may be needed to aid navigation during the low water seasons. It is the opinion of competent engineers that no such reservoir could be constructed in the Ohio Valley, and that, consequently, a site must be looked for further down. The St. Francis basin with its area of 6,706 square miles is the one toward which the eyes of the engineers have been mostly turned. Mr. James A. Seddon, assistant engineer of the Missouri River Commission, has estimated that to take care of the surplus waters on the Cairo gage above the height of 44 feet would require a reservoir of 4,655.6 square miles in extent and 10 feet deep. If the depth should be increased to 15 feet, the area required would be reduced one-third, or to 3,103.7 square miles. This immense quantity of water could be stored in five or six reservoirs, into which the basin could be subdivided by means of cross levees, and set free at low water times when needed for purposes of navigation. It is claimed that with this surplus there would always be sufficient water for the heaviest draft steamboats below Helena, provided the proper amount of care were exercised in disposing of it. The cost of this work is variously estimated at from $40,000,000 to $50,000,000, including compensation to private citizens for property, or about $70,000,000 cheaper than the cost of leveeing the whole river and reveting its banks. It is also presumed that the cost of the necessary annual repairs would not be so great. By this means the flow of water would be materially reduced, the flood danger below minimized, and the levees would not have to be built so high, even though the Yazoo, White, and Tensas basins, with their 13,000 square miles of territory, were to be permanently closed.

It has been frequently suggested that a high water canal could be cut through at Bonnet Carre, La., from the river to Lake Pontchartrain, and thereby relieve the situation below in times of flood, especially at New Orleans. This scheme had some advocates, and likewise some bitter enemies. The

possibilities of the case, as near as I can compute them, are as follows, taking the flood of 1897 as the maximum condition, and the danger line of 45 feet at Vicksburg as the line above which the water would begin to run off into the canal. At the time of the maximum stage of 52.3 feet the discharge in cubic feet per second was about 1,600,000, while at the 45-foot stage it was about 1,300,000. The difference of 300,000 feet is the quantity which it is desired to dispose of through the proposed canal. Assuming the velocity of the current to be 4 miles per hour, which is equivalent to 5.87 feet per second, the cross section of the canal would have to be $300,000 \div 5.87 = 51,107$ square feet. Therefore, if the depth were to be 30 feet, the width would have to be $51,107 \div 30 = 1,703.6$ feet, and its length would be about 12 miles. Both banks would need protection by revetments to secure permanency. I can give no close estimate of the cost of such a work, but I think it could be done for $20,000,000 or less. On paper it certainly appears feasible. Opponents of the canal argue that it would gradually fill up by deposits of sand, but this objection is met by the reply that it applies equally to any portion of the river, and the canal, owing to its comparatively limited extent, could be effectually dredged to the required depth whenever necessary.

Above the mouth of the Missouri attempt has been made to lessen the flood heights by building storage reservoirs at the head waters. Five of these reservoirs were built, with a view to store surplus waters, which should be available for purposes of navigation when the low-water season set in. These anticipations were not realized, however. The floods were repressed to some extent as far as Lake Pepin, but not below, and as much as 1 foot of additional water was available at the low-water season at St. Paul, disappearing by the time Redwing, Minn., 52 miles below, was reached. In any event, with or without reservoirs, no floods north of Lake Pepin are felt to the southward to any considerable extent.

The effect in the lower river of an all levee system upon navigation would be to narrow the channel and, consequently, increase the velocity of flow during high water, thereby retarding somewhat the upstream movement of boats. Relief would come quicker, however, owing to the greater velocity of the water, as it would, of course, run off sooner. In times of low water it is probable that, there being no overflow or back water to run into the main stream and the levees causing a greater velocity in the flow of the water already there, the low-water season would be prolonged and still lower stages prevail than had obtained in the past. This would be impossible with the storage reservoir, as the surplus water could be let into the river just as needed.

This completes about all I have to say upon this subject, and I beg of you to bear in mind that I do not come here as an expert in these matters; I simply present to you the facts as I have gathered them in various ways. The subject is certainly one of deepest importance, and justifies almost any expenditure of time and money to produce satisfactory results. The proper improvement of the Mississippi River may require thirty or forty years of time and may cost $300,000,000. It could probably be done in one-half the time and for one-half the money or less. But no matter what the cost, the moral, social, and economic development of many millions of people is directly concerned, and it is not always wise to too closely reckon the cost in mere dollars and cents.

SMALL WHIRLING COLUMNS OF MIST.

By RALPH B. MARBAN, Weather Bureau, dated October 25, 1899.

On Sunday, October 22, a very interesting meteorological phenomenon was observed by me at the upper or receiving reservoir on the Conduit road a few miles above Washington. It was about 7:30 of a perfectly clear, calm, frosty morning. Over the mirror-like surface of the pond hung a ragged mist from 5 to 10 feet deep and so thin that it did not obscure objects on the opposite shore, some three hundred yards distant. When first seen there was no perceptible movement in this veil of mist; it rested almost motionless on the surface of the lake. Soon, however, it was noticed that it had begun to drift hither and thither in all directions. In two places within 50 or 100 feet of each other the movement would be in opposite directions. Almost simultaneously with the beginning of this movement of the fog there appeared whirls or spouts in the mist, seeming to form where two nearly opposite currents of air met, as shown by the drifting mist. Some of the columns were evidently formed as rolls between two parallel opposed currents. When first formed these spouts were from 2 to 4 feet in diameter, extending but 2 or 3 feet above the surface of the water and rotated (counter clockwise) but five or six times per minute. The speed of rotation rapidly increased, however, until at the end of half a minute or so it would be about thirty or forty per minute, the diameter decreasing at the same time to from 6 to 18 inches, while the column grew until about 20 feet in height. The column appeared hollow, the denser mist being in the outer ring. In the fully developed whirls there was a well defined upward spiral motion, the angle of ascent being, as nearly as could be judged, between 45° and 60° with the horizontal. Although some of these spouts lasted probably as long as five or six minutes, their average life was about two minutes, but within the twenty or twenty-five minutes during which the phenomenon was observed a great many, probably over a hundred, of these little whirling columns of mist were seen. Generally they had no progressive motion, although a few wandered aimlessly here and there. Gradually the number of the spouts diminished and finally in about half an hour no more were formed, the mist in the mean time having become almost entirely dissipated, partly by the rising sun and partly by the mixture of dry air.

Of course one could not witness a phenomenon of this kind without trying to discover its cause. It seems to the writer that the lower stratum of air had become heated by radiation from the comparatively warm water, but as no disturbing incident occurred it lay in the hollow over the lake in a state of unstable equilibrium. As soon as something happened, however, to disturb this equilibrium the cold overlying air began to fall and crowded up the warm, light stratum beneath.

The scene was one of great beauty. In the eight or ten acres of the lake in view there would be a great number of these minature columns of mist standing in relief against the dark pines in the background and as erect as they.

ADDITIONAL OBSERVATIONS OF THE ST. KITTS, W. I., HURRICANE.[1]

By W. H. ALEXANDER, Observer.

About noon of Thursday, September 7, the wind changed from the northeast to the north, from which direction it blew steadily with an average velocity of 17 miles per hour until 2 a. m. of the 8th, when it began varying between north and northwest and increasing in force. About 5 a. m. it set in steadily from the northwest and continued from that direction until 1 p. m., when it began shifting to the west and increasing rapidly in force. From 1:45 to 3:40 p. m. the wind came from the west with an average velocity of about 36 miles per hour. At 3:40 p. m. it shifted to the southwest and soon reached verifying velocity. About 3:15 a. m. of the 9th, the wind began blowing from the south, and by noon it was coming steadily from that direction.

[1] From a second report by Mr. Alexander, we copy the following additional details, received too late to be inserted in the chapter on Forecasts and Warnings.

The hurricane began at 3:40 p. m. and ended at 2:25 a. m. of the 9th, lasting, therefore, ten hours and forty-five minutes, during which time there was a total wind movement of 514 miles, giving an average of 48 miles per hour. The maximum, 62 miles per hour, occurred between 8:18 p. m. and 8:23 p. m. The extreme, 120 miles per hour, occurred at 5:51 p. m. The wind was from the southwest during the entire storm.

The following special barometer readings were made, viz:

September 8	5:30 a. m.	29.743
	7:00 a. m.	29.742
	8:00 a. m.	29.724
	9:00 a. m.	29.703
	10:00 a. m.	29.675
	12:00 noon	29.598
	1:00 p. m.	29.578
	2:00 p. m.	29.536
	3:00 p. m.	29.532
	4:00 p. m.	29.517
	5:00 p. m.	29.506
	6:00 p. m.	29.518
	7:00 p. m.	29.536
	8:00 p. m.	29.617
	9:00 p. m.	29.644
	11:30 p. m.	29.689
September 9	1:00 a. m.	29.678
	2:00 a. m.	29.685

PROCEEDINGS OF THE MEETING OF THE INTERNATIONAL METEOROLOGICAL COMMITTEE, AT ST. PETERSBURG, SEPTEMBER 2-7, 1899.

By A. Lancaster, from notes by St. Hepites, Director of the Meteorological Institute of Roumania.

[Translated by the Editor from Ciel et Terre, September 1899, p. 339.]

The International Meteorological Committee held its annual meeting at St. Petersburg from the 2d to the 7th of September. The attendance was not very numerous; only eight members of the Committee were able to accept the invitation of General Rykatcheff, Director of the Central Physical Observatory of Russia.

The opening session was presided over by His Imperial Highness the Grand Duke Constantine, who delivered a very interesting address which elicited great applause. He referred to the service rendered to meteorology by Kupffer, the founder of Russian climatology. After this address the various reports submitted to the committee for discussion were read as follows:

1. Report by Rücker on terrestrial magnetism and atmospheric electricity.

It was decided to maintain the Committee on magnetism as a distinct organization, but under the immediate control of the International Committee.

2. Report by Hildebrandsson on the observations of clouds.
3. Report by Hergesell on balloon ascensions.
4. Report by Violle on solar radiation and insolation.

In the session of September 3, the question proposed by General Rykatcheff was considered: "Is it desirable that the International Committee should consider earthquake observations?" The response was as follows:

"The Committee recommends that meteorological institutions contribute to seismic observations."

The question of antarctic exploration was also discussed at this session.

The Committee expressed the opinion that it is highly desirable: (1) That the results of such explorations should be supplemented by the data from the observatories already existing in the Southern Hemisphere and by that obtained from vessels navigating the seas of that hemisphere; (2) that new meteorological stations be established in the southern portion of the Southern Hemisphere, and especially that magnetic observatories be organized there; (3) that magnetic determinations over the whole globe be made in conjunction with those of exploring expeditions.

The interesting investigations of Hildebrandsson on the great centers of atmospheric action gave rise to the following resolution:

"The Committee appreciates the great interest attached to systematic observations made in those regions of the globe which seem to have a special importance in relation to our knowledge of the general circulation of the atmosphere."

The Committee is very happy to be informed by von Bezold and Mascart of the plans of His Serene Highness the Prince of Monaco as to the establishment of a complete meteorological and magnetic observatory in the Azores. His Highness, as we know, is aided in the execution of this project by Captain Chaves of the Portuguese Navy who has been devoting himself to this work for several years.

On the subject of the "Definition of the meteorological day," it was decided that:

"If the computation of the daily mean be not made according to the exact formula:

$$\left(\frac{0^h + 24^h}{2} + 1^h + 2^h + 3^h \ldots\ldots + 23^h\right) \div 24,$$

it will be proper to consider the observation at midnight as belonging to the end of the day, as is done at most stations, and to adopt the formula:

$$(1^h + 2^h + 3^h \ldots\ldots + 24^h) \div 24."$$

On the subject of the proposition of Hann to publish in a special form and definite manner the tables of the diurnal variation of the temperature for each country, the Committee, while fully appreciating the interest and importance of this proposition, is of opinion that, as this question is one of general interest, it should be considered by a special commission [subcommittee] which could decide upon a form of table to be used by all countries. While awaiting the final decision as to this form, the directors of the various meteorological institutions will certainly be glad to furnish the data in manuscript for their first order stations whenever requested.

As to the importance of actinometric observations (a question also introduced by Hann) the Committee can not do otherwise than concur in the wish expressed by this eminent Austrian meteorologist. It hopes that the commission on radiation and insolation will kindly examine the subject and make a report on it to the next International Congress. Violle has already presented a note on the various methods of making actinometric measurements; this note will be published in the Proceedings of the Committee.)

On the following proposition by Pernter that: "It is desirable that observations with the psychrometer be restricted and that observations with the hair hygrometer be increased," the Committee made no decision. A complete review of the subject must first be furnished.

In a letter sent to the Committee, Paulsen, Director of the Meteorological Institute of Denmark asks for the establishment of a cable between Iceland and Europe in the interest of weather predictions. It is well known that for a long time meteorologists have insisted upon the great importance of receiving, daily, information as to the current atmospheric conditions in Iceland, in order to improve the predictions of the weather for England and the states of western and northern Europe. But as the limited commercial intercourse between Iceland and Europe does not promise a sufficient income to compensate for the expense of laying a cable, therefore, the idea of the establishment of telegraphic communication between that island and the coast of Scotland has never been carried out.

The solution of the question has, however, been greatly advanced, thanks to the intelligent initiative of the Danish

Government and the support of the Great Northern Telegraph Company (Grande Compagnie des Télégraphes du Nord). This company undertakes, for an annual payment of only 337,500 francs (about $68,000), during twenty-five years, to establish and work a cable starting from the Shetland Islands, touching at the Faroe Islands, and ending in Iceland. The Danish Government, on its part, will defray the expenses of the establishment and maintenance of the necessary meteorological stations and of the daily meteorological cablegrams; it will undertake to complete the hydrographic work that is a necessary preliminary to laying the cable, and, finally, it will pay an annual subvention of 125,000 francs for twenty years.

It therefore only remains to obtain a further annual sum of 212,500 francs in order to definitely assure telegraphic communication with Iceland, and this would be equally as important to the interests of commerce as it would to the needs of meteorology. It is believed that the states of northern Europe and America, which are especially interested in the realization of this project, will certainly guarantee the money that is still needed.

According to Paulsen's proposition these various states should, in order that this project may be carried out, subscribe for ten years to the meteorological cablegrams that will be sent.

The committee can only confirm the opinion that it has already expressed on several occasions, as to the great importance of the daily telegraphic communication of information relative to the atmospheric conditions in Iceland. It also expresses a hope for the success of the efforts made in this matter by the Danish Government.

A proposition was then made by Neumayer and von Bezold relative to the publication, by the Deutsche Seewarte in Hamburg, of a periodical international bulletin of the weather. According to the authors it should appear as an appendix to the Hamburg daily Wetterbericht, and contain a table of 10-year means of the daily international a. m. observations for about 100 stations. These means of temperature, barometric pressure; and rainfall should appear in columns alongside of the normal values for these three elements.

The Committee was of opinion that it would be useful to have a model of the proposed publication, in order that each meteorological service might appreciate its scope and form an idea as to the extent to which it could cooperate in it.

A committee was appointed, composed of Messrs. Pernter, Billwiller, Neumayer, Rykatcheff, Mohn, and Tacchini, under the presidency of Pernter, to consider the extension and improvement of the international service of meteorological telegrams for use in the prediction of the weather.

Finally, it was decided that the International Committee and the various commissions or subcommittees appointed at the Conference at Paris in 1896, and now present in St. Petersburg (i. e., the commissions on aeronautics, magnetics, solar radiation, weather telegraphy, etc.), should meet in 1900 in Paris immediately after the Congress on Meteorology, which will be held on the occasion of the Exposition. This Congress will probably assemble during the first half of September.

The meetings of the Committee were agreeably diversified by excursions and instructive visits to the principal scientific establishments in St. Petersburg.

On the day of the opening there was at 9 p. m. a reception at the Central Physical Observatory Nicolas.

The following day (Sunday) an excursion to Cronstadt and Peterhof on a naval vessel.

On Monday, a visit to the Winter Palace and to the Gallery of the Hermitage.

On Tuesday, an excursion to the Aeronautic Park, and thence to the Magnetic and Meteorological Observatory at Pavlosk.

On Wednesday, a visit to the Astronomical Observatory at Poulkova.

On Thursday, an inspection in detail of the Central Physical Observatory. In the evening, a conference given by General Tillo to the Geographical Society.

On Friday, a visit to the Imperial Library and to the Bureau of Weights and Measures.

This program shows that the time was well filled during the whole week of the meeting of the Committee. The Russian Government, according to its traditions, always receives with great magnificence the scientists who hold their meetings in Russia, and on this occasion it extended a grand welcome to the meteorologists. The delegates have carried away with them a most agreeable remembrance of their visit to St. Petersburg.

NOTES BY THE EDITOR.

RESULTS OF WORK WITH BALLOONS AND KITES AT TRAPPES, FRANCE.

In the Comptes Rendus, Paris, July 10 and August 21, 1899, Monsieur L. Teisserenc de Bort, the proprietor of the Meteorological Observatory of Trappes near Paris, gives some account of recent work at that place. In his first article he says:

The use of kites for carrying self-registers up into the free air has for several years been practised successfully by the meteorologists of the United States. During the past four years, Mr. A. Lawrence Rotch has accumulated very interesting data at the Blue Hill Observatory near Boston.

Since the autumn of 1897 we have been carrying on analogous researches at the Observatory for Dynamic Meteorology at Trappes[1] and in the course of the year 1898 our self-registers have often attained an altitude of 2,000 meters (6,562 feet).

During the present year, thanks to the improved construction of our kites, according to the Hargrave cellular system, which is also employed in America, we were able to raise our apparatus to 3,940 meters (12,927 feet) on June 14; to 3,950 meters (11,778 feet) on the 15th; and more than 3,300 meters (10,827 feet) on July 3.

The atmospheric soundings made at Trappes on more than a hundred days clearly show the different characters of the rate of diminution of temperature with altitude within the areas of high pressure and within the areas of low pressure, respectively. Within the high areas, as soon as one rises a few hundred meters above the soil, he perceives the rate of decrease of temperature to be diminishing and indeed often observes an inversion of the rate; in the low areas, on the contrary, the rate of diminution is rapid and attains the value indicated by the adiabatic rate for air that has more or less moisture.

With respect to the winds our ascensions show: (1) That during clear weather and high barometric pressure the velocity of the wind generally diminishes in proportion as we ascend above the ground up to an altitude that varies between 1,500 and 3,000 meters; (2) on the other hand, for cloudy weather and areas of low temperature the wind increases appreciably with the altitude, particularly in the neighborhood of the stratum of lower cloud.

In his second article on the temperature of the free air, as shown by 90 ascensions of the sounding balloon, M. Teisserence de Bort says:

The knowledge of the distribution of temperature with altitude at different seasons of the year and under different meteorological conditions is a fundamental datum for the physics of the globe and for meteorology.

Hitherto our information as to the temperature of the free air has been very limited because of the small number of scientific balloon ascensions carrying observers to great heights, and also because these

[1] Trappes is 7 miles from Versailles and about 36 kilometers, or 16 miles, west-southwest from the office of the Central Meteorological Bureau of Paris.

ascensions could not be made in bad weather, so that a large class of interesting atmospheric conditions have escaped our investigation.

The employment of the sounding balloon, on the other hand, inaugurated in 1894 by French aeronauts, has permitted us to carry out repeated explorations of the atmosphere under all circumstances.

We have, during the past two years, at the Observatory for Dynamic Meteorology, studied the lower strata of the atmosphere by means of the kite, and have added thereto systematic explorations of the upper regions by means of the sounding balloon.

After some preliminary trials our useful work began at Trappes in April, 1898, and has been executed at different intervals each month since that date. The ascensions followed each other very closely at certain times in order to follow the changes that were then going on in the atmosphere. We have thus accumulated a mass of scientific documents which is without doubt by far the most important of all that exists relative to this subject, for it contains more than 100 ascensions of sounding balloons, of which 7 surpassed 14,000 meters (8.70 miles); 24 surpassed 13,000 meters (8.08 miles), and 53 attained an altitude of at least 9,000 meters (5.59 miles).

As the value of the records given by the self-registers depends above all upon the precautions taken to assure their accuracy, we have taken great care, as I have stated to the Academy of Sciences in my note of July 11, 1898, to thoroughly protect the thermometer from all sources of error. Various improvements have been made in our apparatus, but the instruments used by us in our first ascensions have been quite recently also used simultaneously with those recently constructed, and have given comparable results.

The series of observations is, therefore, homogeneous throughout.

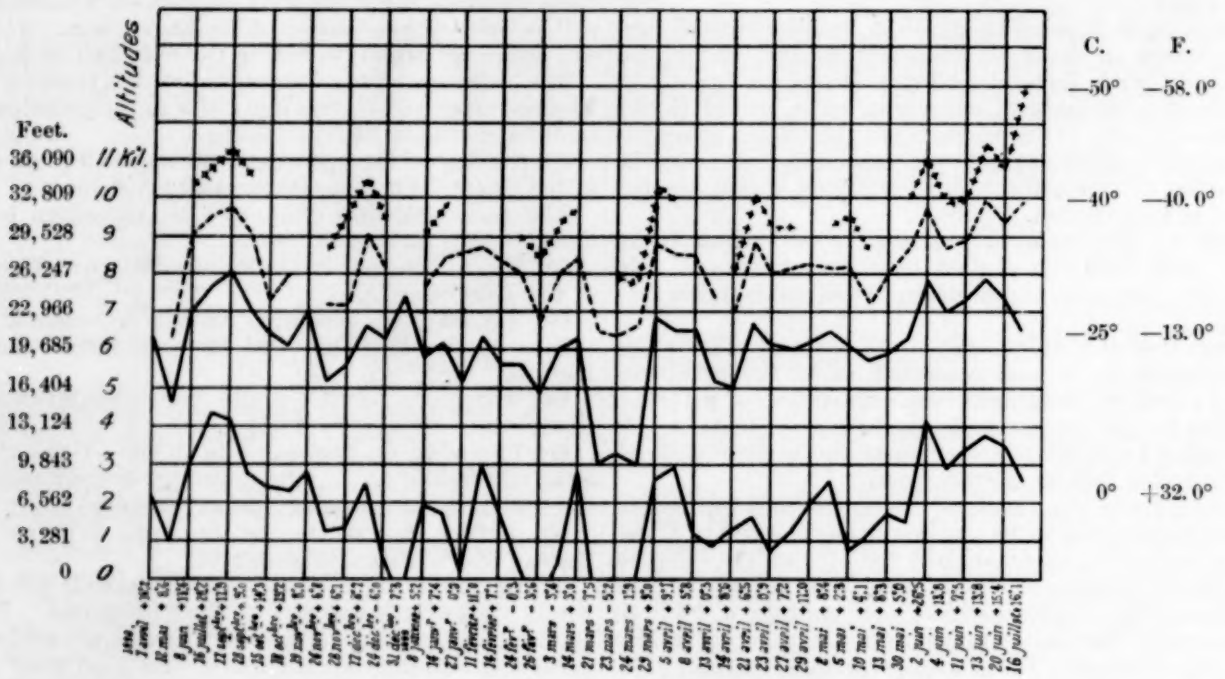

FIG. 1.—Isotherms in free air above Trappes, France.

This diagram shows the height at which the isotherms of 0°, —25°, —40°, —50° C, were encountered on the respective dates. Below the zero line are given both the dates and the temperatures of the air observed at the ground when the balloon started on each ascension. The isotherms of —40° and —50° are not given for certain ascensions; these gaps are due to the fact that the balloon did not rise high enough to encounter those temperatures.

The readings of the curves recorded by the sounding balloons have enabled us to prepare the diagram herewith, which for the first time gives us an idea of the temperature of the free air and its variations in the course of a year, at an altitude of 11,000 meters (36,090 feet or 6.84 miles). In order not to complicate this diagram we have restricted ourselves to showing therein only the altitudes at which the balloons have recorded certain characteristic temperatures: 0°, —25°, —40°, —50° C. (32°, —13.0°, —40.0°, —58.0° F.).

From the discussion of all these documents the following generalizations result:

1. The temperatures at various heights present important variations in the course of a year, and rather larger than have hitherto been admitted according to previous observations made in ordinary balloons.

The temperature 0° C. occurs at very different altitudes, which explains the variations of temperature at the ground, which latter often falls to this temperature in the winter, although it is strongly heated in summer. Thus the isotherm of 0° C., which sometimes touches the ground, or does not exist at all within the atmosphere proper (of course, when the temperatures are negative below), is at other times high above and in the warm season may even be found at 4,000 meters.

The isotherm of —25, which ordinarily remains far above the ground, is also subject to great variations in altitude. In the winter time we find it at about 3,000 meters, and in the summer time above 7,000. In September we have even found it above 8,000 meters; there may be a variation of 5,000 meters in altitude in the course of sixteen months of observations and, probably, we have not yet observed the extremes.

The isotherm of —40° falls many times to near 6,000 meters, and is ordinarily found in the neighborhood of 9,000, sometimes exceeding this altitude, especially toward the end of summer.

The temperature of —50° C., has never been found below 8,000 meters; its greatest altitude has been 12,000 in September, 1898, and July, 1899. It therefore varies at least 4,000 meters.

We see that even at this altitude, where we have passed upward through two-thirds of the whole mass of the atmosphere, the variations of temperature are still very considerable.

2. According to these observations it would seem that even up to 10,000 meters there may be a quite marked tendency to an annual variation of temperature, the maximum taking place toward the end of summer and the minimum at the end of winter; but this phenomenon varies very decidedly from day to day, depending on the changes in the atmospheric situation; thus in the same season, for example, we find the isotherm of —40° at 8,500 meters on March 14, 1899, but at 6,600 meters on March 24.

If we calculate the variability of the temperature at various heights by determining the positive or negative departures of temperature for each ascension, from the general mean for that altitude, we see that beginning a short distance from the ground up to an altitude of 9,000 meters the departures do not vary much with altitude.

The following table, based in general on the results of 80 ascensions, gives the mean departures for two groups of temperature observations of very nearly equal importance. It shows, contrary to that which has hitherto been accepted, that there is no rapid diminution of thermal variability with altitude. It is, however, probable that the distribution of these departures in a vertical direction varies with the type of weather.

The rate of vertical diminution of temperature varies appreciably from day to day, and these variations, like those of the temperatures themselves, have some connection with the different atmospheric conditions.

Altitude above ground.		Mean departures.				Mean of *a* and *b* by weight.	
		a		*b*			
Meters.	*Feet.*	° *C.*	° *F.*	° *C.*	° *F.*	° *C.*	° *F.*
171	561	5.36	9.6	5.75	10.3	5.53	10.0
1,000	3,281	5.48	9.8	5.14	9.3	5.30	9.4
2,000	6,562	5.54	10.0	5.74	10.3	5.64	10.1
3,000	9,843	5.97	10.7	6.30	11.3	6.11	11.0
4,000	13,124	6.17	11.1	6.50	11.8	6.36	11.4
5,000	16,404	5.91	10.6	6.32	12.3	6.34	11.4
6,000	19,685	6.53	11.8	6.63	11.9	6.59	11.9
7,000	22,966	6.81	12.3	6.15	11.0	6.45	11.6
8,000	26,247	6.45	11.6	5.76	10.4	6.05	10.8
9,000	29,528	6.61	11.9	4.81	8.7	5.55	10.0

a Balloon ascensions between April, 1898, and the middle of February, 1899.
b Balloon ascensions between February and July, 1899.

PRELIMINARY RESULTS OF WEATHER BUREAU KITE OBSERVATIONS IN 1898.

We have already stated in the MONTHLY WEATHER REVIEW that after the preparatory work in the construction of kites and meteorographs had been brought up to a favorable condition by Prof. C. F. Marvin, it was ordered by the Chief of the Weather Bureau that a number of stations should be equipped with this apparatus and observers drilled in its use, so that the determination of atmospheric conditions over a considerable extent of country, at the height of a mile above sea level, might be carried out in a systematic manner, day by day, subject only to the omissions that necessarily occur when rain or calm prevented a kite ascension. In addition to the experimental station at Washington, sixteen others were provided for early in the year 1898, and regular observations began during the latter part of the month of April. The records for the six warmer months, May to October, inclusive, have now been partially reduced by H. C. Frankenfield, Forecast Official, and published under the title of Weather Bureau Bulletin F. Vertical Gradients of Temperature, Humidity, and Wind Direction. A Preliminary Report on the Kite Observations of 1898.

Owing to the unexpected demands suddenly precipitated upon the Bureau by the war with Spain, and the consequent immediate extension of the Weather Bureau Service over the West Indies, kite work was temporarily relinquished in November, 1898; but three stations still continue making ascensions, one daily, and two whenever possible.

As the kite undoubtedly offers the best possible method of getting at the true temperature of the atmosphere in perfectly free air, at considerable altitudes, it was especially important that the temperature observations should be promptly reduced and published. Dr. Frankenfield's report probably gives us the most extensive information available as yet as to the conditions of the atmosphere up to the height of a mile above the surface of the ground. The details of the observations and computations are given in full for the use of special students in Bulletin F, but the following general results will be of universal interest.

The Marvin kite-meteorograph keeps a continuous record of pressure, temperature, moisture, and wind velocity, but the adopted plan of observation included frequent additional special observations of the apparent angular elevation of the kite and the length of wire paid out from the reel, whence the true altitude can be computed without depending upon the barograph record. Observations of this kind were made as nearly as practicable at each 500 feet of altitude, while at the same time the rate of ascent or descent of the kite was temporarily checked, so that the thermometer might certainly come to the temperature of the wind at that elevation. These special observations are the only ones discussed in Bulletin F; they usually began early in the morning, but in the case of high ascensions they necessarily lasted over until the afternoon; very rarely were two ascensions made in one day. The mean of the morning and afternoon series generally corresponded to about 10 or 11 a. m., and it is these means that are now reprinted from Dr. Frankenfield's work, to which we must refer for the separate results. The total number of ascensions discussed by him amount to 1217, and the total number of observations of each element, not including those at the ground, amounted to 3,835. The distribution of the ascensions and altitudes is shown in Tables 1 and 2.

TABLE 1.—*Summary of stations and observations.*

Stations.	Elevation above sea level.	No. of months observations.	No. of kite ascensions.	Number of observations at the respective altitudes above ground.									
				1,000 feet.	1,500 feet.	2,000 feet.	3,000 feet.	4,000 feet.	5,000 feet.	6,000 feet.	7,000 feet.	8,000 feet.	Total.
Washington	115	5.0	87	51	52	53	28	19	9	7	3	1	223
Cairo	315	5.5	39	6	33	31	23	19	4	....	.....	.....	116
Cincinnati.....	940	5.0	38	3	7	24	19	16	9	3	.....	.....	81
Fort Smith	527	5.0	19	12	18	18	8	2	.....	.....	.....	.....	58
Knoxville	990	5.0	19	8	8	8	8	2	.....	.....	.....	.....	34
Memphis	319	4.3	37	16	22	27	26	21	5	.....	.....	.....	117
Springfield, Ill..	684	5.0	46	15	52	53	28	15	9	2	.....	.....	174
Cleveland	705	5.0	93	29	62	55	48	21	11	1	.....	.....	227
Duluth.....	1,197	5.5	96	61	71	83	60	32	13	5	.....	.....	325
Lansing	869	5.0	58	23	23	22	34	22	10	.....	.....	.....	134
Sault Ste. Marie	722	5.3	74	7	42	46	39	31	15	.....	.....	.....	180
Dodge	2,473	6.0	138	119	123	118	106	66	22	10	2	1	573
Dubuque	894	5.7	65	19	32	40	35	15	7	.....	.....	.....	148
North Platte ...	2,811	6.0	132	70	162	133	102	44	13	1	.....	.....	525
Omaha	1,241	4.5	61	0	29	50	45	34	19	6	2	.....	185
Pierre	1,595	5.5	184	96	105	91	65	38	19	2	.....	.....	416
Topeka	972	6.0	81	68	65	76	72	26	11	1	.....	.....	319
Total.....	.....	.....	1,217	603	906	928	746	423	182	38	7	2	3,835

TABLE 2.—*Mean temperature gradients from the ground up to the respective altitudes and the number of observations.*

Stations.	1,000 feet.	1,500 feet.	2,000 feet.	3,000 feet.	4,000 feet.	5,000 feet.	6,000 feet.	7,000 feet.	8,000 feet.	Total No. of observations.
	°	°	°	°	°	°	°	°	°	
Washington, D. C.....	5.6	4.4	4.0	3.5	3.2	3.0	3.1	3.0	3.0	
	51	52	53	28	19	9	7	3	1	223
Cairo, Ill.....	9.7	6.6	6.0	4.9	4.7	4.3	.....	.....	.....	
	6	33	31	23	19	4	.....	.....	.....	116
Cincinnati, Ohio.....	13.0	6.3	6.9	5.8	5.6	4.7	4.2	.....	.....	
	3	7	24	19	16	9	3	.....	.....	81
Fort Smith, Ark	7.2	7.0	6.7	5.8	3.8	.....	.....	.....	.....	
	12	18	18	8	2	.....	.....	.....	.....	58
Knoxville, Tenn.....	8.4	6.2	6.6	5.4	5.0	.....	.....	.....	.....	
	8	8	8	8	2	.....	.....	.....	.....	34
Memphis, Tenn	7.8	6.8	5.0	3.8	3.7	3.5	.....	.....	.....	
	16	22	27	26	21	5	.....	.....	.....	117
Springfield, Ill	7.6	5.7	5.1	4.4	4.0	3.7	3.6	.....	.....	
	15	52	53	28	15	9	2	.....	.....	174
Cleveland, Ohio	5.7	4.1	3.6	3.5	4.1	4.1	4.3	.....	.....	
	29	62	55	48	21	11	1	.....	.....	227
Duluth, Minn	5.2	4.8	4.6	4.6	4.3	3.8	4.6	.....	.....	
	61	71	83	60	32	13	5	.....	.....	325
Lansing, Mich	7.5	6.0	4.7	4.1	3.9	3.8	.....	.....	.....	
	23	23	22	34	22	10	.....	.....	.....	134
Sault Ste. Marie, Mich ..	6.6	6.2	5.2	4.5	3.9	3.0	.....	.....	.....	
	7	42	46	39	31	15	.....	.....	.....	180
Dodge, Kans.....	6.3	5.2	4.8	3.7	3.1	3.2	3.2	3.2	4.9	
	119	123	118	106	66	28	10	2	1	573
Dubuque, Iowa	6.9	5.9	4.6	3.5	3.2	3.3	.....	.....	.....	
	19	32	40	35	15	7	.....	.....	.....	148
North Platte, Nebr.....	6.8	6.5	5.9	5.2	4.4	4.7	5.4	.....	.....	
	70	162	133	102	44	13	1	.....	.....	525
Omaha, Nebr	.....	5.4	4.9	3.6	3.2	3.5	3.8	4.1	.....	
	.....	29	50	45	34	19	6	2	.....	185
Pierre, S. Dak	5.9	5.1	4.8	4.3	3.7	4.4	4.0	.....	.....	
	96	105	91	65	38	19	2	.....	.....	416
Topeka, Kans.....	7.4	6.2	4.9	4.0	3.8	3.9	4.5	.....	.....	
	68	65	76	72	26	11	1	.....	.....	319
Mean....	7.4	5.8	5.2	4.4	4.0	3.8	4.1	3.4	4.0	
	603	906	928	746	423	182	38	7	2	3,835

TABLE 3.—*Mean decrease of temperature from the ground up to the respective altitudes.*

	1,000 ft.	1,500 ft.	2,000 ft.	3,000 ft.	4,000 ft.	5,000 ft.	6,000 ft.	7,000 ft.	8,000 ft.
	°	°	°	°	°	°	°	°	°
Morning	7.2	5.5	4.8	4.0	3.7	3.7	3.9	3.4	3.0
Afternoon	7.5	6.4	6.0	5.5	4.9	4.3	4.5	3.5	4.9
Mean	7.4	5.8	5.2	4.4	4.0	3.8	4.1	3.4	4.0

TABLE 4.—*Mean decrease of temperature by geographical districts.*

Districts.	1,000 feet.	1,500 feet.	2,000 feet.	3,000 feet.	4,000 feet.	5,000 feet.	6,000 feet.	7,000 feet.	8,000 feet.	No. of stations.	Ascensions.	Observations.
	°	°	°	°	°	°	°	°	°			
Atlantic coast	5.6	4.4	4.0	3.5	3.2	3.0	3.1	3.0	3.0	1	87	223
Central Mississippi watershed	9.0	6.4	6.0	5.0	4.5	4.0	3.9	.....	.....	6	198	580
Upper Lake region	6.2	5.3	4.5	4.2	4.1	3.7	4.4	4.0	.....	4	321	805
Central west	6.6	5.7	5.0	4.0	3.6	3.8	4.2	3.6	4.9	6	611	2.166
										17	1,217	3,835

At the present stage of its development, the Weather Bureau kite, having 68 square feet of supporting surface, can not be depended upon to carry up the Marvin meteorograph, weighing 2.2 pounds avoirdupois, unless the wind blows at the rate of 10 miles per hour. These present observations, therefore, do not relate to calm weather, such as prevails in the central portion of an area of high pressure; neither do they relate to the stormy and rainy weather within an area of low pressure, except in a few rare cases; but, in general, they do fairly represent the condition of the atmosphere in all intermediate stages. The percentage of actual to total possible ascensions varied from 75 at Dodge to 12 at Knoxville.

The observed temperatures are not published in this bulletin, but the individual rates of change from the ground up to any given altitude are all given, so that local gradients may be deduced and studied.

In Tables 2, 3, and 4 we have given the most general results, such as may be supposed to represent the annual average condition of the atmosphere. The means at the bottom of Tables 2 and 3 apply in a general way to the average for the six warm months over the entire territory between latitudes 35°–50° N. and longitudes 75°–100° W. Some such general means as these are needed in computing the general reduction of surface temperatures and pressures to the upper 1-mile level in order that we may compare the isobars and isotherms deduced from observations at the surface of the earth with those that are based upon records obtained by the kite meteorograph. Doubtless the actual observed temperatures and pressures for these kite ascensions, as well as the upper and lower reduced values, will be published at some future time.

The inversions of temperature on many occasions were quite appreciable. These cases were evenly distributed through the six months, and extended up to 1,500 feet in the early morning in some cases. In general, strong inversions took place with light southerly winds, but slight inversions with strong northerly winds. The presence of clouds diminished the fall of temperature greatly, and in some cases was accompanied by a decided rise of temperature. Dr. Frankenfield's summaries give the gradients for both the morning and afternoon observations separately, as also for clear and cloudy weather. He has also given the cases of inversion in detail.

In using the temperature gradients here given, the reader will recall that the figures represent the differences between the temperature at any specified height and that at the ground, divided by the height expressed in units of 1,000 meters. These quotients, therefore, are the average gradients throughout each such column from the ground up to any given height. They can not properly be supposed to hold good for the middle point of each column unless the diminution of temperature follows a very simple law. If we desire to know the average gradient at the center of any column 1,000 feet in height, we must reconstruct the curve of temperature and measure off the local gradient at the desired altitude.

The altitudes stated at the top of each column are supposed to be measured from the ground upward and not from sea level; therefore, in order to obtain the gradient at any point above sea level one must consider the altitude of the ground given in Table 1. This has been attempted by the Editor in Table 5, which gives the average distance from each station up to the stratum that is 1 mile above sea level, and the average gradient of temperature from the ground up to that level. It also gives the resulting reduction to be applied to the surface temperature in order to reduce it upward to that level, which, however, is strictly applicable only to the general average of the six months of observation. One-half of this reduction is the argument for obtaining the temperature correction for use in reducing surface pressures for the 1-mile level. Finally, the table gives the average temperature gradient at the 1-mile level for each of the seventeen kite stations.

TABLE 5.

Districts and stations.	Altitude of ground at reel.	Depth below 1-mile level.	Average gradient up to 1-mile level.	Reduction from ground to 1-mile level.	Correction to ground temperature to get column temperature.	Average gradient at the 1-mile level.
Atlantic coast.	*Feet.*	*Feet.*	°	°	°	°
Washington, D. C.	115	5,165	—3.00	—15.5	— 7.8	—3.0
Central Mississippi Valley.						
Cairo, Ill	315	4,965	—4.30	—25.6	—12.8	—4.3
Cincinnati, Ohio	940	4,340	—5.15	—27.5	—13.8	—5.3
Fort Smith, Ark	527	4,753	.....	.....	.....	.....
Knoxville, Tenn	990	4,290	—5.00	—21.5	—10.8	—4.9
Memphis, Tenn	319	4,961	—5.50	—17.3	— 8.6	—3.5
Springfield, Ill	684	4,596	—3.85	—17.7	— 8.8	—3.8
Upper Lakes.						
Cleveland, Ohio	705	4,575	—4.10	—18.8	— 9.4	—4.1
Duluth, Minn	1,197	4,083	—4.30	—17.6	— 8.8	—4.3
Lansing, Mich	869	4,411	—3.85	—17.0	— 8.5	—3.9
Sault Ste. Marie, Mich.	722	4,558	—3.45	—15.7	— 7.8	—3.5
Central west.						
Dodge City, Kans	2,473	2,807	—4.10	—11.6	— 5.8	—3.9
Dubuque, Iowa	894	4,386	—3.30	—14.5	— 7.2	—3.2
North Platte, Nebr	2,811	2,469	—5.40	—13.3	— 6.6	—5.5
Omaha, Nebr	1,241	4,039	—3.20	—12.9	— 6.4	—3.2
Pierre, S. Dak	1,595	3,685	—3.90	—14.4	— 7.2	—3.9
Topeka, Kans	972	4,308	—3.88	—16.5	— 8.2	—3.8

In Table 6 we have made an attempt to determine for the warm season the gradient at the middle point of each thousand feet of altitude. In order to do this, the average gradient from the ground up to any altitude, being multiplied by this altitude, gives the figures in the column headed "Total fall of temperature." The next following column gives the differences between these successive diminutions expressed as gradients per thousand feet. These gradients hold good approximately for the middle of each layer. One might interpolate midway between them in order to obtain the gradients at every 500-foot level, but the irregularities apparent in these figures suggest caution in this process.

TABLE 6.

Altitude above ground, feet.	Average gradient from the ground.	Number of observations.	Total fall in temperature.	Gradient per 1,000 feet at each level.
	°		°	°
8,000	— 4.0?	2	—32.0?	.....
7,500	.....	.....	.....	— 8.2?
7,000	— 3.4?	7	—25.8?	.....
6,500	.....	.....	.....	+ 0.8?
6,000	— 4.1	38	—24.6	.....
5,500	.....	.....	.....	— 5.6
5,000	— 3.8	182	—19.0	.....
4,500	.....	.....	.....	— 3.0
4,000	— 4.0	423	—16.0	.....
3,500	.....	.....	.....	— 2.8
3,000	— 4.4	746	—13.2	.....
2,500	.....	.....	.....	— 2.8
2,000	— 5.2	928	—10.4	.....
1,750	.....	.....	.....	— 3.4
1,500	— 5.8	906	— 8.7	.....
1,250	.....	.....	.....	— 2.6
1,000	— 7.4	603	— 7.4	.....
500	.....	.....	.....	— 3.7
0	.....	3,835	— 0.0	.....

The relative humidity was recorded by means of a special form of hair hygrometer, and this, combined with the temperature, gave the vapor pressure computed for each observation. The average relative humidity is given in Table 7. The ratio of the vapor pressure at any upper altitude to that at the earth's surface is given in Table 8. The results of work with balloons and kites are compared in Table 9, and give a remarkable confirmation of Hann's well-known formula.

TABLE 7.—*Mean relative humidity.*

[S=at ground, A=above.]

Stations.	1,500 ft.		2,000 ft.		3,000 ft.		4,000 ft.		5,000 ft.		6,000 ft.		7,000 ft.		8,000 ft.	
	S	A	S	A	S	A	S	A	S	A	S	A	S	A	S	A
Washington	76	68	75	67	77	64	75	61	80	60	78	66	73	59	79	58
Cairo	68	67	65	66	68	64	62	62	60	65	....	....	...	....	....	...
Cincinnati	70	67	65	68	64	63	66	68	65	64	63	70	....	....	....	....
Fort Smith	63	72	63	76	63	82	71	79	....	....	....	...	....	....	....	....
Knoxville	55	63	61	71	72	75	64	64	....	....	....	....	...	...	...	....
Memphis	59	70	67	77	72	77	69	69	60	62	....	....	....	....	....	....
Springfield, Ill	61	45	60	42	57	36	46	24	53	26	50	24	....	....	....	....
Cleveland	74	71	74	72	73	72	69	65	69	75	78	94	....	....	...	....
Duluth	70	72	66	69	60	65	62	64	61	57	58	57	54	70	....	....
Lansing	78	69	76	68	72	69	61	68	65	64	...	...	...	....	...	....
Sault Ste. Marie	80	71	73	69	73	69	63	68	59	73	....	....	....	....	....	....
Dodge	57	52	57	58	55	56	52	42	48	51	45	50	32	42	22	47
Dubuque	70	73	72	73	65	66	66	58	67	71	....	....	....	....	....	....
North Platte	53	56	51	56	47	53	46	52	42	49	30	60	....	....	....	...
Omaha	48	40	50	40	49	33	53	30	62	24	67	15	66	10	....	...
Pierre	57	63	56	61	55	66	52	60	43	58	48	64	....	.. .	....	....
Topeka	61	69	62	67	63	64	60	59	62	61	63	63	....	....	....	...
Means	65	64	64	65	64	63	61	58	60	57	58	56	56	45	50	52

TABLE 8.—*Vapor pressure.*

Diminution with altitude $\left(\frac{p}{p_0}\right)$.

Stations.	1,500 feet.	2,000 feet.	3,000 feet.	4,000 feet.	5,000 feet.	6,000 feet.	7,000 feet.	8,000 feet.
Washington, D. C.	0.87	0.82	0.66	0.60	0.54	0.46	0.45	0.31
Cairo, Ill.	0.71	0.69	0.63	0.54	0.54	.....	.....	.....
Cincinnati, Ohio	0.73	0.69	0.57	0.51	0.49	0.45	.....	.....
Fort Smith, Ark	0.82	0.79	0.74	0.65	.....	.....	.....	.....
Knoxville, Tenn	0.83	0.73	0.66	0.76	.....	.....	.....	.....
Memphis, Tenn.	0.88	0.86	0.76	0.61	0.54	.....	.....	.....
Springfield, Ill	0.74	0.70	0.63	0.52	0.48	0.49	.....	.....
Cleveland, Ohio	0.83	0.77	0.68	0.55	0.55	0.48	.....	.....
Duluth, Minn.	0.82	0.79	0.74	0.64	0.57	0.56	0.45	.....
Lansing, Mich	0.87	0.83	0.73	0.56	0.51	.....	.....	.....
Sault Ste. Marie, Mich	0.83	0.76	0.71	0.71	0.44	.....	.....	.....
Dodge, Kans.	0.85	0 84	0.80	0.71	0.61	0.56	0.51	0.55
Dubuque, Iowa	0.83	0.79	0.76	0.56	0.56	.....	.....	.....
North Platte, Nebr.	0.78	0.72	0.66	0.57	0.40	0.65	.....	.....
Omaha, Nebr	0.83	0.80	0.68	0.56	0.39	0.23	0.15	.....
Pierre, S. Dak	0.90	0 86	0.75	0.72	0.69	0.69	.....	.....
Topeka, Kans.	0.85	0.80	0.68	0.56	0.52	0.36	.....	.....
Mean	0.82	0.78	0.70	0.61	0.52	0.49	0.39	0.44

TABLE 9.—*Decrease of vapor pressure with altitude.*

Value of $\left(\frac{p}{p_0}\right)$ for the respective altitudes.

Character of observations.	1,500 feet.	2,000 feet.	3,000 feet.	4,000 feet.	5,000 feet.	6,000 feet.	7,000 feet.	8,000 feet.	No. of observations.
Kites	0.82	0.78	0.70	0.61	0.52	0.49	0.39	0.44	1,123
Balloons (Hammon)	0.96	0.96	0.87	0.68	0.44	0.59	.....	.....	4*
Balloons (Hazen)	0.89	0.83	0.80	0.78	0.67	0.46	0.44	.....	2*
Balloons (Hann)	0.84	0.80	0.66	0.61	0.50	0.54	0.41	0.37	15†
Mountains (Hann)	0.83	0.81	0.80	0.66	0.61	0.58	0.55	0.47	6†
Computed by Hann's formula.	0.85	0.81	0.72	0.65	0.58	0.52	0.47	0.42	.....

*American Meteorological Journal. †Meteorologische Zeitschrift, IX, 1874.

The velocity of the wind was not recorded, owing to the fact that the small and light anemometer designed to accompany the meteorograph could not be completed and tested in time for use.

The direction of the wind at any elevation is almost exactly given by the azimuth of the kite. A general study of these directions is given by Dr. Frankenfield in connection with each station, and may be summarized as follows:

The upper winds show an increase in velocity and a slight progressive deflection toward the right, increasing with the altitude, and rarely exceeding 90°. In the few cases of deflection toward the left, the velocity of the wind, as shown by the pull on the kite wire, diminished with increase of altitude. In a slight majority of these cases of deflection toward the left, rain followed within a few hours. The diurnal changes of the upper and lower winds were strongly marked at Duluth.

THE AVERAGE TEMPERATURE OF THE ATMOSPHERE.

When a long and complete series of observations with sounding balloons and kites becomes available, we may determine with great accuracy the normal temperature of the atmosphere over any station for each thousand meters of altitude up to great heights. Meanwhile, however, the diagram given by Teisserenc de Bort in an article that we have translated and published on page 412 tempts us to make a first approximation to this fundamental datum in dynamic meteorology. We can, however, only reason cautiously upon the data given by himself as the results of systematic work at Trappes, near Paris. As a first approximation, the Editor offers the mean monthly temperatures and annual averages given in Table 1, as representing an average year between April, 1898, and July, 1899. This is a rather bold and hazardous attempt at generalization, but when we consider that according to his own statement, the mean departure of the temperature from the mean at any given altitude in all types of weather, ranges from 5.2° nearest the ground to 6.6° C. at 6,000 meters, we see at once that the annual averages given in this table have some slight value as an approximation to the normal, provided no systematic instrumental errors intervene. Better figures will doubtless be given by the author himself at some future date.

TABLE 1.—*Approximate mean temperatures (Centigrade) observed in free air at Trappes during* 1898–99.

Altitude (kilometers).	January.	February.	March.	April.	May.	June.	July.	August.*	September.	October.	November.	December.	Annual mean.	Means of departures. Daily observations.	Means of departures. Monthly means.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
10	−50	−55	−55	−55	−68	−44	−45	(−45)	−45	−55	−55	−50	−51	.....	4.8
9	−45	−45	−50	−45	−50	−38	−35	(−35)	−36	−45	−45	−40	−42	5.6	4.8
8	−35	−39	−44	−39	−40	−31	−28	(−28)	−28	−40	−40	−35	−38	6.0	4.8
7	−30	−31	−40	−32	−32	−23	−21	(−21)	−22	−30	−33	−30	−29	6.4	4.6
6	−25	−26	−32	−25	−24	−14	−15	(−14)	−13	−20	−25	−23	−21	6.6	5.2
5	−20	−21	−26	−17	−17	−10	− 9	(− 8)	− 7	−13	−18	−18	−16	6.3	4.8
4	−13	−11	−21	−12	−12	− 5	− 3	(− 2)	− 2	− 7	−12	−12	− 9	6.4	4.7
3	− 8	− 8	−14	− 7	− 7	0	+ 2	(+ 2)	+ 1	− 2	− 3	− 7	− 4	6.1	4.2
2	− 4	− 4	− 6	− 4	− 3	+ 6	+ 8	(+ 7)	+ 6	+ 2	0	− 4	0	5.6	4.5
1	+ 1	+ 2	− 2	+ 1	+ 1	+10	+12	(+12)	+11	+ 8	+ 3	0	+ 5	5.2	4.8
0	+ 4	+ 4	0	+ 5	+ 6	+15	+20	(+18)	+15	+14	+ 6	0	+ 9	5.5	6.2
Mean date	16	19	19	18	12	10	16	(19)	22	16	24	24	.....	.....	.....
No. obs	3	4	6	9	6	6	2	0*	2	2	3	3	4.9	.....	.....

*The temperatures for August are interpolated.

It would not be proper to consider these figures as representing any other locality than the neighborhood of Paris. If the irregularities of temperature continue above the same as below, no matter how high we ascend in the atmosphere this shows that the general currents of air and the presence of clouds or haze control the temperatures. Such currents and moisture conditions change with the season, the relative position of land and water, and the latitude. The existence

and motions of the cirrus cloud show that the general circulation of the atmosphere affects it to a height of 10 miles, and that average temperatures and gradients at that height must differ systematically according to the currents and moisture appropriate to the location of the station. The figures for Trappes may possibly represent, in general, France, Holland, and Denmark, but can hardly represent Great Britain or Norway or the interior of Europe, still less the eastern portion of the United States.

Although, relying implicitly upon the diagram published in the Comptes Rendus, we should be cautious about drawing conclusions finer than are warranted in view of the well-known sources of error incidental to all such observations.

In Table 1 we have included a column given by Teisserenc de Bort, showing the average departures of his individual temperatures from average values, from which we see that there is an average variability of 5° or 6° in the temperature of any one horizontal stratum, whence the mean temperature of the month should have a "probable uncertainty" of about 1.5° and the mean of the year 1°, as compared with normal values that would result from a very long series of observations. We have also added a column showing the mean departures of our present monthly values from their respective annual means.

The mean of all the departures of any observed temperatures from their average value is not quite the same as the so-called "probable departure" or "probable error." If we assume that the temperature of a stratum is constant throughout the whole series of observations, then any observed departure from this mean is like an error in making a measurement. Such errors are governed by certain laws, which, if they are unknown to us and can not be otherwise handled, must be treated as though they were due purely to chance. There will be fewer large but more small departures; the larger errors will have a smaller chance of occurring. The chance of occurrence of an error will diminish as the size of the error increases, but not exactly in the same proportion. The precise law, as given by the "theory of probabilities," is a logarithmic equation; that is to say, the logarithm of the probability of the occurrence of an error as large as x will decrease in proportion to the increase of the square of x. This probability is very neatly shown by a curve, called the "probability curve," whose ordinates represent the probabilities of the occurrence of the errors that are represented by the corresponding abscissas. Every value of x is possible and has its corresponding probability of occurrence; there is a special medium value, such that there will be as many others above it as there are below it, so that the chance of the occurrence of this particular error is just one-half. This is not "the most probable error," but has for a century past been adopted as a convenient index to the internal agreement or discrepancy of the observations among themselves and is called "the probable error." Instead of this, Teisserenc de Bort adopts the average of all the departures as an index to the agreement of the observations among themselves. The laws of probability show that "the probable error" is found approximately by multiplying the "mean of all the errors" by the factor 0.8453.

It is frequently necessary to calculate the average of the sum of the squares of the individual errors. The square root of this average is called "the *mean* error," not the mean of the errors, and from this "the *probable* error" may be found by multiplying by the factor 0.6745.

According to the figures given by Teisserenc de Bort for each horizontal stratum of air, the "mean of the departures" of the individual measurements of temperature vary between 5.5° and 6.6°. The corresponding mean of the departures for monthly mean temperatures will be found by dividing these latter figures by the square root of 30, and will, therefore, be about 0.9° and 1.1°, respectively. The mean of the departures of the respective annual means would be found by dividing by the square root of 365, and would, therefore, be about 0.3° C.

If we study, by themselves, the monthly means for each stratum, as given in Table 1, and form a system of twelve departures from their annual means, we find the means of these departures vary between 6.2° and 4.2°, as shown in the last column of the table, that is to say, the probable departures of the monthly means vary from 5.2° to 3.5°, respectively. These are so much larger than the 0.9° and 1.1° just quoted in the previous paragraph as to show that the changes in temperature due to annual periods are quite as important as those due to daily irregularities.

The "probable error" of each of the annual means for the respective altitudes would range from 1.1° to 1.7° as deduced from the monthly means, and assuming that there be no systematic annual periodicity and no important systematic instrumental error.

When we examine the column of annual means for the purpose of determining the average rate of decrease of temperature with altitude, we have to remember not only the annual periodicities and accidental irregularities in the actual temperatures of the air as just calculated, but that an important systematic instrumental error may also exist. These temperatures have all been determined by means of a self-register that ascended rapidly, and after a while descended rather more slowly to the ground. Now, every thermometer, and especially those of such registering apparatus, requires a little time to follow the changes of temperature to which it is subjected. The so-called sluggishness of the thermometer is a source of error as important as the variability of the actual temperature. Table 1 brings out the fact that throughout all these ascensions there has been a steady diminution of temperature with altitude, amounting to somewhere between 50° C. and 65° C. in 10 kilometers, and averaging exactly 60° C. Now, when a thermometer is plunged into a bath whose temperature is 60° lower than its own, and is stirred rapidly about in a large mass of water, so that the external surface of the glass bulb keeps a constant temperature of —60°, the interior glass and mercury requires some time to attain that temperature. It may be five or ten minutes, being longer in proportion to the poor conduction and convection of heat by the bulb. The temperature shown by the thermometer follows a logarithmic law of decrease, and after coming close to the temperature of the bath there is still an outstanding error of a few hundredths of a degree or, possibly, of a whole tenth. For any given difference of temperature between the bath and the thermometer, there is a certain rate at which the thermometer will change its temperature in its efforts to attain equilibrium with the liquid. If the liquid holds its own temperature constant, the thermometer will ultimately approximate equality with it.

But the thermometer in an ascending sounding balloon comes at every moment into new liquid whose temperature is lower than that of the preceding layer, it is, therefore, attempting to fall to the temperature of a liquid whose temperature is itself falling. If the balloon is ascending quite uniformly, so that the rate of fall in the temperature of the bath is uniform, then the cooling thermometer soon attains such a temperature, (a little above that of the air) that for this difference of temperature its own rate of fall is just the same as that of the uniform diminution of the temperature of the bath. When this condition has been attained the thermometer will, indeed, cool as fast as the temperature of the air falls with the rising balloon, but the thermometer will always be behind the temperature of the air by a constant number of degrees corresponding to a constant difference in altitude, and this may continue indefinitely.

To illustrate this by an example, suppose that the thermometer be one of those used by me at Poulkova in 1865, and whose correction for sluggishness is given on page 72 of my "Treatise on meteorological apparatus and methods," Report of Chief Signal Officer, 1887. In this case, when the temperature of the bath is one degree lower than the temperature of the thermometer, the latter cools at the rate of 0.255° per minute. If the temperature of the bath is some other quantity, such as N degrees cooler than the thermometer, the rate at which the latter will cool is $N \times 0.255°$ per minute.

If the difference of temperature is 4° the rate of cooling will be 1.02° per minute. If now, this thermometer is ascending in a balloon through layers of cooler air at such a rate that it rises 10 kilometers in an hour, and if the air temperatures diminish as they do in the column of mean annual temperatures in Table 1, namely, 60°, in this interval, then the thermometer is, as it were, in a bath whose temperature is falling 1° per minute. Therefore, our thermometer which can cool at the rate of 1.02° per minute when the bath temperature is 4° below its own, will soon come to a temperature of about 4° behind, that is to say, 4° warmer than that of the layer of air in which the balloon is located at any moment. This 4° in temperature corresponds to a vertical distance of $\frac{4}{9}$ of a kilometer for the assumed temperature gradient in the free air, therefore all recorded temperatures will be 4° too high for the altitude, and really belong to a layer of air $\frac{4}{9}$ of a kilometer lower down. The converse will hold good for descending balloons.

In applying the preceding argument to the self-registers used at Trappes, we recall that some similar instruments have shown a degree of sluggishness such as would be represented by a much larger figure than the 0.255° used in the above illustration. Thus in his report, on pages 34–92 of the Protocol of the Strasburg Meeting, April, 1898, of the International Aeronautic Commission, Teisserenc de Bort says:

> In rapid ascents the temperature of the air can vary 2° or 3° per minute, since the balloons rise at the rate of from 4 to 9 meters per second, and descend with velocities of 2 or 3 meters per second. Thus the temperature recorded at a given altitude when the balloon is rising may be 14° in excess of that indicated for the same altitude when it is descending.

Again, in the same protocol, pages 93–103, Professor Hergesell gives the coefficient of "sluggishness," (whence by inversion we compute the coefficient of sensitiveness) for two Richard self-registering thermometers that have actually been used in some voyages with sounding balloons. When these thermometers are ventilated with sufficient rapidity, e. g., in a wind blowing at the rate of from 3 to 10 meters per second, in air of constant temperature, the coefficients of sensitiveness increase as the speed of ventilation and the attending increase of conduction and convection. They are, respectively, 1.3° or 1.6° for a velocity of 3 meters per second, and 5.0° or 6.2° for a velocity of 10 meters per second in air. This coefficient is, however, subject to a diminution with the diminution of convection in rarified air, and would therefore become perhaps one-fourth of the values here given, i. e., 0.4° and 1.5° for the air at the highest portion of an ascension. Professor Marvin's experiments at the Weather Bureau on the coefficient of sensitiveness of his own kite thermograph under an atmospheric pressure of 30 inches, indicate a value of 0.9° C. for a ventilation of 3 or 5 meters per second.

Under these conditions we see that even if the corrections for sluggishness have been approximately determined and applied to the observations on which Teisserenc de Bort has based his chart, yet there is room for considerable uncertainty of a systematic nature and we are quite safe in saying that the annual mean temperatures given in Table 1 are, on this account alone, still probably open to systematic corrections.

Beside the sluggishness of the self-registering apparatus, by virtue of which recorded temperatures are too high when ascending and too low when descending, the apparatus comes under the influence of solar radiation which warms it, and the surrounding air carried along with it, so that it tends to give records that are too high. This error is partly counteracted by artificial ventilation and by the convection due to the rapidly ascending motion of the balloon, but becomes very serious when the balloon has reached the upper limit of its ascent and is floating along with the local current of air. The converse holds good at nighttime, but to a much less degree when the apparatus is cooling by its own radiation without being warmed by the sunshine.

In the absence of any definite information as to the extent to which the balloon records have been affected by various sources of error, we may still cautiously draw from the annual means some interesting conclusions based on the following considerations:

The temperature of the air depends primarily upon the processes of cooling by radiation and warming by conduction and convection. The former tends to keep the earth's surface cold and the layer of coldest air lies close to the ground; this tends to bring the whole atmosphere into a condition of stable static equilibrium in which the temperature increases with altitude; the vertical gradient, therefore, is positive and may have any value up to infinity.

The process of convection carries warm and moist air upward in one place only to descend in another. In this boiling process the ascending currents cool by expansion and the descending currents warm up by compression. The tendency is to keep the whole atmosphere in thermo-dynamic equilibrium and the temperature diminishes with altitude. The vertical gradient is negative and may be anywhere between —2.0° C. and —9.9° C.

The general average between stable static and unstable dynamic conditions for the whole globe gives an "equilibrium gradient" of about 5° C. per 1,000 meters, as a close approximation to the annual average condition of the whole atmosphere up to the highest point that the sounding balloons have as yet attained. It would appear that at these greatest heights the convective processes are still as effective as at the surface, and it may be doubted whether there is any height to which they do not attain.

The adiabatic rate of change of temperature in dry air is that which would prevail in a mass of air ascending or descending without changing its quantity of internal heat, and is 9.9° C. per 1,000 meters; this is the same as that which would prevail if the loss of heat by internal processes were exactly counterbalanced by the absorption from outside sources; it is the same as that which prevails when the air rises or falls so rapidly that it has no time to lose or gain any heat. In moist air, not cloudy, it averages 9.8° C., but within cloudy air, with rain or snow in process of formation, it may be as low as 2.0° C. At the upper surface of a cloud there is a break or discontinuity in the gradient, owing to the absorption of solar heat by the cloud particles in the daytime and the radiation of heat by them at night time. The gradient will, therefore, vary with the speed of ascent or descent. The gradient 5° per kilometer may be taken as an approximation to that which the general condition of the air as to moisture, convection, and radiation appears to impose on the whole atmosphere.

TABLE 2—*Approximate observed diminution, with altitude, of temperature of free air at Trappes.*

Altitude (kilometers).	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual mean. Observed.	Equilibrium.	Difference.	Adiabatic diminution.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
10	—54	—59	—55	—60	—66	—59	—65	—63	—60	—69	—61	—50	—60	—50	—10	—98
9	—49	—49	—50	—50	—56	—53	—55	—53	—51	—59	—51	—40	—51	—45	— 6	—88
8	—39	—43	—44	—44	—46	—46	—48	—46	—43	—54	—46	—35	—47	—40	— 7	—79
7	—34	—35	—40	—37	—38	—38	—41	—39	—37	—44	—39	—30	—38	—35	— 3	—69
6	—29	—30	—32	—30	—30	—29	—35	—32	—28	—34	—31	—23	—30	—30	0	—59
5	—24	—25	—26	—22	—23	—25	—29	—26	—22	—27	—24	—18	—25	—25	0	—49
4	—17	—15	—21	—17	—18	—20	—23	—20	—17	—21	—18	—12	—18	—20	+ 2	—39
3	—12	—12	—14	—12	—13	—15	—18	—16	—14	—16	— 9	— 7	—13	—15	+ 2	—29
2	— 8	— 8	— 6	— 9	— 9	— 9	—12	—11	— 9	—12	— 6	— 4	— 9	—10	+ 1	—20
1	— 3	— 2	— 2	— 4	— 5	— 5	— 8	— 6	— 4	— 6	— 3	— 6	— 4	— 5	+ 1	—10
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

The temperatures corresponding to the adiabatic rate, 9.8° for dry air, and the equilibrium rate, 5.0°, are shown in columns seventeen and fifteen, respectively, of Table 2, and the departures of the observed temperatures from the equilibrium rate are shown in column sixteen.

It will be noticed that up to 4 kilometers the observed annual mean diminution of temperature for Trappes is slightly less than that which we call the equilibrium rate, but the differences are within the limits of the general uncertainty or probable error of the annual means. On the other hand, between 7 and 10 kilometers, the observed diminutions are greater and the temperatures are appreciably cooler than equilibrium would require, that is to say, the atmosphere above Trappes is so cold at these heights that it has a tendency to descend to the earth's surface. Of course, in doing so it warms up by compression, and, therefore, sinks down only so fast as the cooling by radiation may counteract the dynamic heating, so that the air may still appear cool when it eventually arrives at sea level. An examination of the means for separate months shows that this tendency prevails throughout the year at the 8, 9, and 10-kilometer level, but is most pronounced in the warmer half of the year; it also prevails in the warmer half at the 7-kilometer level. In other words, the annual change of temperature at the ground is, in general, inverse to that which takes place in the upper strata. This inversion we must attribute almost entirely to the annual changes in the circulation of the atmosphere, by virtue of which the warm air that in the summer months left the surface of the ground in far distant warm regions has, after a long journey, been brought to the region above Trappes, and has been cooled by radiation until it is now pressing its way down to the ground.

The little that we know about the movements of the upper air favors the presumption that the upper southwest wind, or antitrade, flowing from the equatorial to the arctic region is slowly descending, except in special regions, where underlying continents and mountains or underflowing northeast and northwest winds, or some form of wave or vortex disturbance temporarily forces it to rise a little. The formation and dissipation of the highest cirrus clouds seems to suggest the localities over which this current has a special ascending or descending motion, but far above these clouds similar motions must take place in regions ordinarily inaccessible to observation. The locations of these regions must be subject to annual changes somewhat corresponding to the seasonal shifts in the locations of our large subpermanent areas of high and low pressure. The gradients of ascending and descending motions in the atmosphere, at and above the level of the cirrus clouds, are probably steep enough to produce great velocities, on account of the wonderful mobility of the air, whose internal friction or viscosity, diminishes rapidly with temperature. A mass that ascends at the equator to the height of 20 kilometers, and descends at the pole to the surface of the earth, must flow along an average grade of $\frac{20}{10000}$ or $\frac{1}{500}$. This grade produces a swift rapid in a river of water and can produce a velocity of 100 miles per hour in the free air.

The radiation of heat by a pure and dustless gas is a very small quantity, but it may be greatly increased by the presence of dust or such vapors as aqueous vapor, ammonia, or carbonic acid gas. Several attempts have been made to determine the actual coefficient of radiation (see my article on "Atmospheric Radiation," American Journal of Science, May, 1892, Vol. XLIII, p. 364, reprinted in The American Meteorological Journal, 1892, Vol. VIII, p. 549).

The rate of radiation of a unit mass of air doubtless varies with its altitude, its temperature, pressure, moisture, dust, &c., but our first crude approximation must assume it to be constant and that its effect, namely, the lowering of the temperature of the mass, goes on in proportion to the lapse of time and the gradient of temperature outward from it toward the surrounding region or the inclosure. The lowest value that has been suggested as plausible for the coefficient of radiation is one that would cause a mass of air to cool at the rate of 2.88° C. per day by radiation toward an inclosure that is 1° cooler than itself. On the other hand, the dynamic cooling of an ascending mass of gas, or the dynamic heating of a descending mass, depends essentially upon the changes of pressure and the resulting expansion or compression that it experiences; for moist, air without cloud, it amounts very closely to 0.98° C. for a change in elevation of 100 meters, although it is quite common to use the approximate ratio of 1° C. per 100 meters. Adopting 0.98°, we see that a change of 294 meters in altitude would correspond to a change of 2.88° C. in temperature. Hence, the dynamic warming, due to a descent of 294 meters in one day, would just counteract the cooling due to the loss of heat by radiation during one day. In general, the total cooling during the time (t), expressed in days, due to the effect of radiation (k) *plus* the effect of a change of altitude at the rate of r meters per twenty-four hours, is expressed by the formula

$$T - T_0 = k\,t + c\,r\,t = (k + c\,r)\,t,$$

where c is the rate $-0.98°$, as above given. If we assume $k = -2.88°$ and give r a number of assumed values, as in the first column of the accompanying Table, 3, positive for ascending and negative for descending air, then the total change of temperature in twenty-four hours will be as given in the second and third columns. If these total changes of temperature be divided by the vertical distances in the first column, there results the rate of change in temperature per 100 meters of altitude as given in the fourth and fifth columns. These latter are gradients, properly so called; the altitudes are supposed to increase positively when measured upward; the observer ascends, although the air is descending; therefore the numbers given in the fifth column have the opposite sign to those in the third column.

TABLE 3.

Assumed daily rate of change of altitude.	Corresponding temperature gradient per 100 meters.		Resulting temperature change per day.	
	Ascending	Descending.	Ascending.	Descending.
	°	°	°	°
0 meters	−2.88	−2.88	*	*
147	−4.32	−1.44	−2.94	+0.98
294	−5.76	0.00	−1.96	0.00
441	−7.20	+1.44	−1.63	−0.33
588	−8.64	+2.88	−1.47	−0.49
Infinity	−Infinity.	+Infinity.	−0.98	−0.98

*If the rate of ascent or descent is 0 in the free air, then every particle is in stable equilibrium; no vertical motions can originate spontaneously, and the gradient of temperature may be anywhere between −0.98° and +infinity.

Now, on the average of a whole year, and throughout the atmosphere of the whole globe, each horizontal layer contains equal masses of ascending and descending air, otherwise there would be an increasing accumulation at some place. But it does not follow that at any high point above the earth equal masses of ascending and descending air pass by during the year, since a steady ascent at one place might be counterbalanced by an equal steady descent elsewhere. The average temperature gradient at any place depends, not on the mass that passes by it, but on the rate of rise or fall and on the duration of time occupied by each; it is, in fact, the average of the products of the temporary gradients by the respective durations. Ascents are usually rapid and local, descents are slow and extensive. If the temperature gradients are uniformly distributed throughout the year, then only do the respective times drop out of consideration, and the resulting local gradient depends upon the actual rates of

ascent and descent and the moisture of the air. If the air is not cloudy and the ascending gradients have been the same as the descending gradients, then, the resulting annual average will be the mean of the two figures given on any line in Table 3, that is to say, it will always be 0.98, and will, therefore, be independent of radiation. In other words, in this ideal case of a cloudless atmosphere and rapid convection, the radiation effect is uniformly distributed throughout the mass, and does not affect the vertical gradient, but, of course, this is far from being the actual condition of the earth's atmosphere.

THE INTERNATIONAL ELECTRICAL CONGRESS AT COMO, ITALY.

An International Electrical Congress was held, September 18–25, 1899, at Como, Italy, in connection with the so-called Volta Electrical Exposition. Modern electrical science began with the work done by Volta, who was a native of Como. The exposition opened with brilliant promise early in the present year, and, notwithstanding the disastrous fire that soon followed, the exposition and the congress form an interesting epoch in the history of electricity. The congress was opened with an address by Colombo, president of the Italian Electro-Technic Association, who also represented the minister of public instruction. Many of the most distinguished electricians were present. Among the items that may especially interest meteorologists, we quote the following from the report by Martinez in The Electrical World and Engineer of October 21, page 615:

Professor Blaserna desired the congress to commit itself in favor of the adoption of the double trolley, or of accumulator traction, for lines passing in the vicinity of scientific laboratories. The proposition was not received with much favor by the audience, which was largely composed of a modern element, to whom the disturbances of a galvanometer in a laboratory had much less importance than the economy of electric traction.

Mr. Gisbert Kapp expressed the opinion of the majority of those present in saying that savants, instead of asking that electric traction systems, which gave such great advantages to the majority of citizens, should be changed, should endeavor to perfect their instruments, so that they would not be disturbed from that cause, and, if this can not be done, they should move their laboratories to the country, far away from electric railways.

M. Campelio expressed his agreement with Mr. Kapp.

Mr. Pinna, director of the Turin electric plant, said that accumulator cars differed little from the trolley in their effects on delicate instruments.

Mr. Mengarini, director of the electrical plant at Rome and engineer of the project of transportation of power from Tivoli to Rome (2,000 horse power at 6,000 volts, a rash proposition in 1891), sought to give some satisfaction to Professor Blaserna, in speaking of the serious trouble produced by electric railway return currents on water and gas pipes. He asked, not that the earth return should be prohibited, but that, in the insulation of street railways, all possible precautions should be taken to avoid damage from the return currents.

The discussion having begun to extend over a wide ground, the president adjourned it to the next meeting, and gave the floor to Professor Blaserna, who read a paper on the variation of the earth's terrestrial magnetism in antiquity. The idea of the investigation was due to a learned and very modest coadjutor of Professor Blaserna, Dr. Folgheraiter, of the University of Rome. Dr. Folgheraiter had observed that earthenware will preserve indefinitely the magnetism that it possessed when it was baked. Etruscan vases, roman bricks, etc., he found presented magnetic phenomena so striking as to enable the terrestrial magnetic conditions existing when they were baked to be deduced. The etruscan vases of the year 600 B. C. showed with certainty that at that epoch the direction of the terrestrial magnetic field was almost vertical at Rome and in central Italy. Professor Blaserna expressed the hope that similar observations would be made in other countries.

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At the joint session with the Italian Physical Society, on September 21, Professor Somigliano of the University of Como, discussed the changes of levels in the Italian lakes, a matter that was also observed by Volta, in connection with Lake Como. This lake, as well as others in Italy, is subject to abrupt changes of level which cannot be explained on the supposition of increased flow of water from the streams flowing therein. Recently instruments have been installed to make observations on Lake Garda, with a view to making a careful study of the phenomena. Professor Chistoni gave some interesting details on electrical discharges on Mount Cimone, 7,100 feet high high, the highest peak of the Apennines in the Tuscany and Lombardy region. An observatory has been placed on the summit of this mountain, where aerial conductors have been installed to study the phenomena of atmospheric electricity, which so much interested Volta.

Professor Voltena read a paper of capital importance on "Energy" in the treatment of which a new method of mathematical analysis was followed.

Professor Lemstrom spoke of the artificial reproduction of the aurora borealis. He advanced the conclusion that there is in the atmosphere a permanent electrical current vertical inflow. Professor Wiedemann did not agree with this opinion, observing that we can not have luminous phenomena with differences of potential as small as those mentioned, which, however, may be caused by alternating currents of high frequency.

In the afternoon of September 22, at the meeting of the Italian Physical Society, Professor Maragoni, of Florence, gave a summary of the different theories of the formation of hail, and concluded that the theory of Volta still remains the most plausible, if slight modifications are applied to it.[1] The discussion was participated in by several of the members.

Señor Zublena proposed that the meeting should express an opinion in favor of the encouragement of theoretical and practical researches relating to hail, the occurrence of which in certain parts of Italy constituted a real affliction.

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Professor Bongiovanni showed an apparatus illustrating the phenomena of terrestrial magnetism, and M. Arno made some interesting experiments on the rotations of insulating disks by electro-static action.

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At the last meeting of the Physical Society, Mr. Rizzi, of Naples, read a paper on the magnificent colorations in the Gulf of Naples. He showed that the explanations which have thus far been given concerning the marvelous coloring of the sea and of the sky in that locality do not suffice.

The meeting expressed the wish that the Italian Government should undertake the publication of the complete edition of all the works of Volta, as it has already done for the works of Galileo.

INSTRUCTIVE LABORATORY EXPERIMENTS.

On another page we publish a short contribution by Mr. Ralph B. Marean on whirling columns of mist. This suggests one of many forms of experimentation practicable in physical laboratories, and essential to the development of exact meteorological science.

It is well known that determinations of the coefficient of viscosity of the air have been made by exact observations upon whirls driven by rapidly-revolving cylinders or circular plates. But in these experiments the inertia of the moving masses is so great that the viscosity becomes a minor matter and is not determined with all the precision that is desirable.

The mist whirls seen by Mr. Marean can, undoubtedly, be formed and observed at pleasure by proper laboratory arrangements. If, as he describes, a whirl of small height but considerable diameter is observed beginning in a lower stratum of mist, but finally is converted into a small, slender, rapidly-rotating column which ascends and is finally converted into a horizontal cloud in which there is no rotation, then it is evident that the ascent is due to the slight buoyancy of the original mass, and probably depends almost wholly upon its having a temperature slightly higher than its surroundings, but the disappearance of the rotation depends on the inter-

[1] It is proper for the readers of the MONTHLY WEATHER REVIEW to remember that according to the theory of Volta, hailstones grow by accretion, as they are alternately repelled upward and downward electrically, between two oppositely charged layers of clouds. This working hypothesis of a century ago is now obsolete in meteorology, and wholly replaced by the convective processes fully explained by Ferrel and the thermo-dynamic processe explained by von Bezold, and abundantly confirmed by observations in balloons and on mountain tops.—ED.

nal friction or viscosity of the moist air, and this connection can be quantitively determined by skillful mathematical and experimental study.

This is but one of a long series of beautiful and fascinating problems in the dynamics of the atmosphere; problems that should attract the students of science in our best universities.

Meteorology has waited long for the collegiate recognition that has lately been accorded it here and there; but its progress is not secured by merely teaching to undergraduates that which is already known; it demands rather that provision be made for the thorough preparation in scientific research of those who desire to devote their lives to the advancement of meteorology. There are half a dozen American universities whose students, instructors, and laboratories could profitably be turned toward the development of those branches of experimental and mathematical physics that bear upon meteorology.

METEOROLOGY IN OUR UNIVERSITIES.

Some years since the Editor sketched out a course of reading, study, and experimentation for the guidance of those students who felt themselves drawn toward this important science, and this course has been announced in the annual catalogues of the Columbian University for a number of years. It has, indeed, never been given by the Editor in full, and may perhaps be too elaborate to be generally practicable. However, it constitutes a comprehensive course of subjects for reading and study that may be useful as a guide to teachers who desire to do the very best that can be done under the limitations imposed by their personal and local conditions.

The courses in meteorology are designed to give a complete review of the present condition of that science, and they extend through six years, but each of the six divisions is complete in itself. Each course presents a detailed view of its branch of the subject, such as may be desired by students who need this information in connection with other branches of knowledge to which they are specially devoting themselves.

In addition to the lectures, the professor devotes one hour a week to a "quiz" class, in which, by questions and answers, he seeks to remove any difficulties that remain.

1. *Observational meteorology.*—Personal diary of the weather; general methods of observing without instruments; the rain gage; the thermometer; the barometer; the nephoscope; the anemometer; hygrometry; actinometry; self-registering apparatus; observations in balloons; observations on mountain stations; meteorological expeditions by land and sea; forms for record; methods of computation of means and normals; graphic methods of presenting results. Two hours per week.

2. *General climatology.*—Elements of climate; general distribution over the earth of sunshine, temperature, moisture, pressure, wind, clouds; diurnal, annual, and secular periodicities; variability of local climates; empirical relations between the winds and the other elements; the absorption of radiations by the atmosphere; the theory of probabilities as used in climatology; the computations of the coefficients of the Bessels-Fourier equation; the climatic features of areas of high and low pressure; the relations between ocean currents and the atmosphere; solar and lunar tides; the constituents of the atmosphere and their variations; atmospheric dust; atmospheric moisture; climatic characteristics of oceanic, continental, and littoral regions; sensible temperatures; constitution of the atmosphere as affected by plants, animals, altitudes, and the ocean; influence of snow, swamps, and forests. Two hours per week.

3. *Special subjects in meteorology and climatology.*—Optical phenomena; thermal phenomena; acoustic phenomena; electrical phenomena; climate and geology; climate and vegetation; climate and anthropology; climate and hygiene; climate and engineering; climate and manufacturing industries; atmospheric dust in relation to rain, geology, vegetation, hygiene, manufactures. Montgomery J. Storm's Cloud Engine. Cloudy Condensation, by Barus, Wilson, and others. The relation of the atmosphere to ordnance operations. Two hours.

4. *Experimental laboratory work in meteorology.*—In this higher field of work the student investigates the theories of several meteorological instruments and pushes his study to some decided advance beyond the present state of knowledge. New apparatus is devised and constructed and the nature of its errors investigated theoretically and experimentally. Old series of observations, conducted with imperfect apparatus and under unfavorable conditions, are reduced and corrected in the light of the newest discussions. The laws of such physical phenomena as have to be considered by meteorologists are investigated by laboratory methods. Among these, for example, are radiation, conduction, and convection of heat; evaporation; the formation of dew, fog, cloud, rain, snow, hail, and lightning; the minute oscillations of wind and pressure; the pressure and movements of the wind, the absorption of radiations from the sun or earth by the atmosphere; the viscosity of the air, convective resistances, etc.; problems in aeronautics, anemometry, kites, resistance of the air to motion; the Schlieren method of Töppler for studying currents and waves of air.

5. *Practical meteorology.*—Methods of projection in cartography; daily weather charts of all nations; international charts of the northern hemisphere; influence of land and ocean on weather and climate; empirical rules as to the variability and constancy of weather and climate in general; the computation of the index of variability of climate by the law of errors; weather types and typical weather charts, both for the United States and for the whole globe; predictions of daily weather by various methods, such as chance, persistency of current conditions, weather types, etc.; special rules for predicting frost, cold waves, rain, snow, and wind; predictions for one, two, and three days; long-range predictions for seasons and climates; precise definition of climate by Hinrich's method, and long-range predictions of Hinrich's climatic exponent; climates in past geological ages; codification of empiric and rational rules for prediction; verification of predictions and the laws of chance involved therein.

6. *Physical and theoretical meteorology.*—Insolation; the absorption, conduction, and radiation of heat by the air, the earth, and the ocean, and the resulting distribution of temperature; the thermo-dynamics of the atmosphere; convective equilibrium; the general circulation of a dry atmosphere on a rotating globe; the influence of oceans and continents, and the motions of the actual atmosphere; local cyclones and anticyclones; atmospheric waves and tides; the distribution of fog, cloud, rain, and snow; optical and electrical phenomena.

WEATHER BUREAU MEN AS UNIVERSITY LECTURERS.

In continuation of our remarks in the MONTHLY WEATHER REVIEW for August, page 365, we note that according to a report from W. M. Fulton, Observer, Knoxville, Tenn., he was authorized by the Chief of the Weather Bureau, in compliance with the request of President Charles W. Dabney to attend farmers and teachers institutes in the State of Tennessee. His absence from station and his expenses were considered a part of his official duty. Mr. Fulton reports as follows:

From August 17 to 21, inclusive, I was engaged in making lantern slides, enlarged charts, and in preparing other equipment for use in my work. I then attended and participated in institutes, as follows: Boons Creek, Tenn., August 22 and 23; Rogersville, Tenn., August 25 and 26; Morristown, Tenn., August 29, 30, and 31; Jackson, Tenn., September 5 and 6; and Larimore, Ala., September 8 and 9, 1899. In regard to the last named point, I would state that Larimore is located in the northeastern portion of Alabama, near the Tennessee State line. I was assured of a large hearing consisting of farmers from north Alabama and east Tennessee, and, not being otherwise engaged, felt it my duty to accept an invitation to lecture at that point. The institute, which was planned for Lenoir City, Tenn., September 12 and 13, was indefinitely postponed in order to avoid conflict with subsequent arrangements made by the State Commissioner of Agriculture.

The institutes enumerated above, except the one at Larimore, were conducted under the supervision of the Agricultural Experiment Station of the University of Tennessee. I was given a prominent place on all programs and took an active part in the work. Stereopticon views (lantern slides), enlarged charts, and milliographed notes were used to illustrate and supplement lectures. The work of the Weather Bureau was explained and discussed. Especial attention was given to the Climate and Crop service; Cotton Region service; cold wave and frost warnings, with some discussion of methods of protection from frost; weather and temperature forecasts, and daily weather charts. The institutes, without exception, were largely attended by intelligent and representative farmers. A decided interest was everywhere manifested in the presentations of the Weather Bureau work. In several instances I was requested to extend a unanimous vote of thanks to the Honorable Secretary of Agriculture and the Chief of the Weather Bureau for having thus brought this work before the institutes. Question boxes contained many pertinent queries concerning all phases of the work. It was my endeavor to first explain the methods which the Bureau is employing to aid the farmer, and, secondly, to furnish information that would enable him to derive the greatest benefit from the service. There was every indication that these two ends were ac-

complished, and I believe it safe to say that the work of the Weather Bureau has thus been brought before a large number of representative farmers of east Tennessee in such a manner as to enlist a lively interest in the service on their part and to awaken in them a due appreciation of the benefits it offers.

By a similar arrangement between the Chief of the Weather Bureau and Mr. Charles R. Skinner, Superintendent of Public Instruction for the State of New York, Mr. A. F. Sims, Local Forecast Official at Albany, was authorized to attend and lecture at the State summer institutes held at Chatauqua, N. Y., and Thousand Island Park, N. Y., during the month of July. About a thousand teachers assembled at each of these summer institutes. The lectures were fully illustrated and devoted especially to the methods of teaching meteorology and were very well received. They were an elaboration of the many similar lectures given by him with great success to the schools of Albany.

MINIMUM TEMPERATURES ON MOUNTAIN PEAKS.

In the August Report of the California Section, Mr. McAdie publishes a note from Prof. J. N. Le Conte, Professor of Engineering in the University of California, giving the results of observations on the summit of Mount Lyell, on the Sierra Nevada Mountains of Central California, latitude, 37° 44′ N.; longitude, 119° 16′ W.; altitude, 13,041 feet.

On July 8, 1897, Professor Le Conte left a minimum thermometer of the United States Weather Bureau pattern on the summit. It was enclosed in a thin wooden box about 6 inches square and 2 feet long, one side of which was laid exactly in line with the edge of the great southern precipice, over 1,500 feet high. Large stones were laid upon it, but one side was exposed to the weather, and in no way could it become entirely covered with snow. On June 5, 1898, the mountain was revisited, and the thermometer box was carefully uncovered. The thermometer was in perfect condition and registered —13.6° F. It was reset and left upon the mountain a second year. Professor Le Conte was unable to make the ascent of the mountain in 1899, but Prof. H. I. Randall of the Civil Engineering Department of the State University visited the spot in July and obtained the reading. In this case it was —17.6° F.

It would be instructive to obtain the minimum winter temperatures of a number of high peaks distributed along the crest of the range from Lake Tahoe to Mount Whitney.

In reference to these Mr. McAdie writes as follows:

The above experiments were made under the auspices of this office, with a view of determining the minimum winter temperatures at the top of the Sierra Nevada Mountains. Mr. J. N. Le Conte, son of Prof. Joseph Le Conte, is an instructor in mechanical engineering in the University of California, and also one of the officers of the Sierra Club. He is an acknowledged authority upon the High Sierra, and I consider that the Bureau has been fortunate in obtaining the services of this gentleman for the experiment.

It is very interesting to note that the minimum temperature on Lyell, elevation 13,040 feet, was —17°, while at Bodie, elevation 8,248 feet, the lowest temperature was —30°. One of the objective points of meteorological investigation at present is the determination of the thickness of the stratum of air in which cold waves are thought to have their origin. I believe it is an accepted fact that the mean temperature of the Plain region is lower than that of the Rocky Mountains, although the latter are from 5,000 to 6,000 feet high. The experiment on the Sierras seems to confirm this. From many other standpoints the experiment is also interesting.

The accuracy of these results depends in part upon the assumption that the thermometer was well ventilated at the time of minimum temperature. So many accidents are liable to occur that it would be desirable to expose two or more thermometers in different places as a check on each other.

AUGUST WEATHER ON THE PACIFIC COAST.

As the temperatures and rainfall on the Pacific coast were quite unusual during August it is interesting to compare the remarks of the respective section directors.

In the California Report, Mr. McAdie says:

The mean temperature for the State was 5.1° F. below the normal. The precipitation was 0.05 inches in excess. The prevailing direction of the wind was west. The central and northern portions of the State experienced unusual and quite severe electrical storms during the first part of the month.

In the Oregon Report, Mr. B. S. Pague says:

The total rainfall during this August has been about 4 inches along the coast, 3 inches in the Willamette Valley, 1 to 2 inches in southern Oregon and 1 inch in eastern Oregon. With rare exceptions the rainfall was heavier than in any previous August. * * * The causes producing the August rains extend back over a considerable period of time. Under the normal movement of the summer areas of high pressure, it is not possible for rain, such as fell this month, to occur. * * * Briefly the cause of the rains was the weakness of the Pacific coast highs, their sluggish movements, the development and strength of the low which came down from the north, uniting with and assisting in the development of lows over southeastern Oregon and the surrounding region. The abnormal August weather of the Pacific slope was preceded by, first, the imperfect movement of the ocean highs in 1898; second, the almost unprecedented cold period of February, 1899; and third, the cool, cloudy, and wet weather of April and May, and the low temperatures of June.

In the Washington Report, Mr. Salisbury says:

The unseasonable character of the month was more pronounced than for any August on record. Its phenomenal character deserves something more than passing notice. The temperature of August has been abnormally low and the precipitation abnormally great. * * * It would be futile to write in learned terms about the unusual southward path of low barometer areas and the unusual frequency of such lows, as producing the unusual rains, or about the unusually low latitude of high areas on the coast producing the cool weather. What is of value to know is what has *caused* the unusual southward track and unusual number and continuance of low areas during August just past, or, perhaps preferably, the reason or reasons why the high areas were this year in an *unusual position*. Such knowledge might be of utility in enabling us to foresee seasonable or unseasonable conditions; unfortunately, it has not, as yet, been attained.

THE CALCULATION OF THE RESULTANT WIND.

Our readers will have noticed that during the past two years we have published in Table VII the resultant direction of the wind computed from two observations, 8 a. m. and 8 p. m. daily. We have also given the average movement of the wind in Table VI, for every hour of the day.

Chart IV for each month shows the resultant winds, graphically, in connection with the isobars which are also the mean of observations at 8 a. m. and 8 p. m. It is commonly supposed that there is a close connection between the wind and the distribution of pressure at any given moment. Consequently, the mean pressures and mean winds at those moments should bring out that relation more clearly. This is a sufficient argument to justify the usage of the WEATHER REVIEW. On the other hand, as the winds are often local and are always subject to small differences of pressure, not shown by means of the ordinary barometric observations, and especially, because the winds at the surface are largely affected by currents descending from the upper atmosphere, where both wind and isobars differ very much from what prevails at sea level, therefore, there are many discrepancies in the observed relation between the resultant winds and the average isobars. These discrepancies would not be diminished if the isobars and the winds were based upon twenty-four observations per day instead of two.

In reply to a recent letter maintaining that our so-called resultants are not absolutely correct, and should be deduced from more frequent observations and by a careful consideration of the measured velocity of the wind, the following reply was sent. Those interested in the subject should study the discussions published in the MONTHLY WEATHER REVIEW during 1893 and 1894.

The principal object in publishing the resultant winds is to afford students and others an opportunity to compare the mean isobars with the mean direction of the wind at 8 a. m. and 8 p. m., seventy-fifth meridian time. As stated in a previous letter on the subject, the Bureau does not attempt to combine the elements of force or velocity with that of time. It is conceded that for a special locality where the general atmospheric circulation is modified by local causes, the mean direction of the wind is best obtained by taking into account the element of velocity as you have done. It has been shown, however, that generally the difference in the velocity of the winds from different points of the compass affects the resultant but slightly, either in direction or amount. (See MONTHLY WEATHER REVIEW, December, 1893, page 365, and Coffin's Winds of the Globe.

In deciding to adopt the present method of computing the mean direction of the wind, we were largely influenced by two considerations, first, a great saving of clerical labor would be effected, and second, the results that would be obtained by the use of the two daily observations, as distinguished from the records by self-registers, would be uniform at all stations of the service. You may be interested in knowing that a comparison of resultant winds, computed by both methods, was carried on throughout 1894. (See Tables VIII and IX, MONTHLY WEATHER REVIEW of that year.)

PROBABLE CLOUDINESS DURING TOTAL SOLAR ECLIPSE OF MAY 28, 1900.

In the MONTHLY WEATHER REVIEW for 1897, p. 394, and 1898, p. 404, Prof. F. H. Bigelow has published his first and second reports, showing the results of special observations made at the request of Prof. D. P. Todd, for the purpose of determining as far as practicable the probability of the occurrence of cloudy weather at different points along the path of totality. The exact location of this path is shown by the narrow band on Chart XI, taken from Professor Bigelow's Bulletin. As many expeditions from astronomical centers throughout the world will be sent to observe the solar and atmospheric phenomena visible in this region during totality, it is important for the astronomer to avail himself of all the information that the meteorologist can furnish so that he may as far as possible diminish the chances of the disappointment that cloudy weather must inevitably bring.

The third and final report by Professor Bigelow, being rather larger than the first and second, will be printed as a bulletin of the Weather Bureau and distributed to astronomers and scientific journals, but some of the results given therein are here quoted for the information of all voluntary observers.

The total eclipse begins on the Pacific Ocean just west of Mexico at sunrise and will be visible at stations located within a narrow band that stretches from that point due eastward over Mexico and the Gulf of Mexico and enters the United States near New Orleans whence it passes northeastward toward Norfolk and Cape Henry and, finally, after crossing the Atlantic Ocean, Portugal, and Algiers, terminates near the northern end of the Red Sea at sunset. In the United States totality begins near New Orleans at 7:20, local mean time, and ends at Norfolk about 9 a. m., local mean time, or between 1:30 and 1:55 p. m., Greenwich mean time. The respective observers can convert these times into the standards, eastern or central time, by applying the proper differences of longitude. The totality of this eclipse will last only about one and a half minutes for those who are located precisely on the line that marks the center of the path of the shadow of the moon, but will be nothing for those on the boundary lines of the path.

The short lines on Chart XI, numbered (1) to (6), drawn across the path of totality, represent the position of the center of the shadow at intervals of five minutes, as it advances along its path; No. (1) corresponds to 1h. 30m. p. m. and No. (6) to 1h. 55m. p. m., Greenwich mean time.

The observations made by voluntary observers during the past three years give uniformly harmonious results as to the probable state of the sky over this region between 8 and 9 a. m., May 28, 1900. If we classify the observers by States, and consider their observations year by year, and also divide the records into two classes according as they give the general cloudiness of the sky and the special cloudiness in the neighborhood of the sun, we obtain the figures given in the following table:

Summary of results for three years.

[The figures are percentages of cloudiness.]

State.	1897.		1898.		1899.		Means.	
	General sky.	Near sun.	General sky.	Near sun.	General sky.	Near sun.	General sky.	Near sun.
Virginia	.....	.....	44.9	41.7	35.7	34.3	40.3	38.0
N. Carolina	35.8	33.3	28.2	25.7	33.3	30.6	32.4	29.9
S. Carolina	33.7	32.1	17.5	16.0	28.1	26.7	26.4	24.9
Georgia	18.4	16.0	12.2	10.8	18.5	17.4	16.4	14.7
Alabama	15.2	14.9	17.1	15.7	22.4	22.6	18.2	17.7
Mississippi	.....	.....	23.0	26.4	38.6	31.9	30.8	29.2
Louisiana	26.5	21.5	36.4	30.9	35.9	30.6	32.9	27.7

In addition to this table, showing the probabilities in favor of good weather, Professor Bigelow's Bulletin gives a mass of information for the benefit of visiting astronomers, showing the railroads, the hotels, the astronomical conveniences, and the resources for enabling heavy baggage to be transported to the path of totality. Undoubtedly the Weather Bureau observers, both regular and voluntary, will receive many calls for assistance in connection with this eclipse of the sun.

THE WEATHER OF THE MONTH.

By ALFRED J. HENRY, Chief of Division of Records and Meteorological Data.

PRESSURE.

The month of September, 1899, was one of high pressure, great dryness, and a high percentage of sunshine.

As compared with the preceding month pressure was markedly higher in all of the interior districts. The geographic center of the country happens to mark the region of greatest increase in pressure, viz, about two-tenths of an inch, which extended from Nebraska southward to Oklahoma and northern Texas. The increase over the whole country, excepting the Florida Peninsula and the St. Lawrence Valley, was greater than a tenth of an inch.

TEMPERATURE OF THE AIR.

The distribution of monthly mean surface temperature is shown on Chart VI which also shows by appropriate lines the monthly maximum and minimum temperatures. During August temperature was below normal in the western part of the country and above in the eastern. These conditions were reversed during the current month. West of the Mississippi River temperature was from 1° to 4° above normal, while over the remaining areas there was a deficiency ranging from a fraction of a degree in the South Atlantic States to 4° in the region about Lake Superior.

Maximum temperatures of 100° and over occurred over a large area in the Mississippi and Missouri River valleys and

also in central and lower California, Arizona, and New Mexico.

Minimum temperatures as low as 15° to 18° occurred in the Dakotas and northern Wisconsin. The low temperatures in northern Wisconsin afford an illustration of the fact that the temperature over an area, say, 50 miles square, may fall 10° to 15° below that of the surrounding country on all sides.

In Canada.—Prof. R. F. Stupart says:

The temperature was above average from Vancouver Island to Manitoba, nearly average in eastern Quebec and the greater portion of the Maritime Provinces, and below average over Ontario and western Quebec, and especially so in the more northern portions. White River was as much as 7° below, Bissett, 6° below, and Montreal, 5° below. Alberta and the North Saskatchewan Valley show the greatest amount above average, amounting to 3°.

FROST.

Frost occurred at one or more stations in the States and on the dates named below: Alabama, 27–30; Arkansas, 27–30; California, 4; Colorado, 23, 28, 29, 30; Connecticut, 7, 15, 16, 27, 30; Idaho, 3, 4, 6, 7, 21; Illinois, 27, 29, 30; Indiana, 19, 27, 29, 30. Indian Territory, 26, 29, 30; Iowa, 13, 17, 18, 20, 25–30; Kansas, 11, 17, 20, 26, 29; Kentucky, 21, 27, 28, 30; Maine, 15–18, 23, 24, 26; Maryland, 14, 15, 28, 29, 30; Massachusetts, 15, 16, 30; Michigan, 12–30; Minnesota, 13, 16–20, 22, 24–30; Missouri, 26, 27, 29, 30; Montana, 3, 4, 6, 7, 8, 15, 16, 18, 28, 29; Nebraska, 16, 17, 20, 24–30; Nevada, 8–12; New Hampshire, 5, 7, 10, 13–17, 22, 23, 24, 28, 29; New Jersey, 15, 28; New Mexico, 17; New York, 3, 7, 10, 13–16, 23, 25, 28, 29, 30; North Carolina, 27, 28, 30; North Dakota, 5, 14, 17, 18, 19, 22, 25–30; Ohio, 30; Oklahoma, 29; Oregon, 7, 8, 29; Pennsylvania, 7, 13–16, 22, 23, 27–30; Rhode Island, 30; South Dakota, 15–20, 24, 25, 26, 28, 29, 30; Tennessee, 26, 27, 28, 30; Utah, 16; Vermont, 14, 15, 16, 20, 22, 23, 28, 29; Virginia, 27–30; Washington, 6, 27, 28; West Virginia, 25, 27, 28, 30; Wisconsin, 12, 13, 14, 18, 19, 20, 23, 26–30; Wyoming, 4, 6–10, 12, 16, 17, 18, 20, 22, 28.

Average temperatures and departures from the normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
		°	°	°	°
New England	10	60.6	− 0.8	+ 0.3	0.0
Middle Atlantic	12	66.1	− 0.9	− 1.8	− 0.2
South Atlantic	10	74.0	0.0	+ 0.1	0.0
Florida Peninsula	7	78.9	0.0	+ 2.1	+ 0.2
East Gulf	7	75.2	− 0.7	− 4.2	− 0.5
West Gulf	7	76.3	+ 0.3	− 2.2	− 0.2
Ohio Valley and Tennessee	12	68.5	− 0.1	− 0.6	− 0.1
Lower Lake	8	60.9	− 2.3	+ 1.5	+ 0.2
Upper Lake	9	56.2	− 2.8	− 6.0	− 0.7
North Dakota	7	55.2	− 0.2	−19.4	− 2.2
Upper Mississippi	11	64.2	− 0 8	− 7.1	− 0.8
Missouri Valley	10	65.3	− 0.2	− 9.2	− 1.0
Northern Slope	7	60.9	+ 2.9	−23.2	− 2.6
Middle Slope	6	68.6	+ 1.2	− 6.8	− 0.8
Southern Slope	6	72.9	+ 1.3	− 8.8	− 1.0
Southern Plateau	13	74.7	+ 3.3	− 4.9	− 0.5
Middle Plateau	9	64.7	+ 2.7	−11.1	− 1.2
Northern Plateau	10	61.6	+ 3.5	−13.7	− 1.5
North Pacific	9	60.0	+ 2.4	−11.6	− 1.3
Middle Pacific	5	66.0	+ 1.2	− 3.6	− 0.4
South Pacific	4	69.7	+ 1.3	− 3.6	− 0.4

PRECIPITATION.

The distribution of precipitation is exhibited on Chart III. The precipitation was above normal in but two districts, New England and the Middle Atlantic States. There were nevertheless areas of considerable extent over which fairly heavy rains fell. One in particular may be found in the panhandle of Texas with branches extending northeastward into Kansas and westward into New Mexico.

Fairly heavy rains also fell in the upper Lake region and the St. Lawrence Valley, but generally there was a deficit of rain.

In Canada.—Professor Stupart says:

The rainfall was largely above average over the middle and eastern portions of Ontario and in western Quebec, below average in western and southwestern Ontario, and also generally below over British Columbia. In the other portions of the Dominion it did not differ much from the average amount except locally; it was, however, for the most part, a little below average in eastern Quebec, the Maritime Provinces, Southern Manitoba and the Qu'Appelle Valley, and above average in the North Saskatchewan Valley. At Toronto the average amount was exceeded by 2.5 inches, at Ottawa by 3.0 inches, at Welland by 3.4 inches, and at Haliburton by 3.7 inches. Montreal was 2.0 inches above average, and Quebec 0.6 below average.

Average precipitation and departures from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
		Inches.		*Inches.*	*Inches.*
New England	10	3.89	122	+0.7	−1.8
Middle Atlantic	12	4.24	112	+0.4	−1.5
South Atlantic	10	2.27	42	−3.1	−5.4
Florida Peninsula	7	6.10	82	−1.3	−3.0
East Gulf	7	1.20	29	−3.0	−9.6
West Gulf	7	1.27	32	−2.7	−8.5
Ohio Valley and Tennessee	12	2.03	67	−1.0	−4.1
Lower Lake	8	2.72	93	−0.2	−5.1
Upper Lake	9	3.24	94	−0.2	−2.3
North Dakota	7	0.64	42	−0.9	−1.9
Upper Mississippi Valley	11	1.88	59	−1.3	+0.4
Missouri Valley	10	1.08	44	−1.4	−5.1
Northern Slope	7	0.37	38	−0.6	−0.7
Middle Slope	6	1.69	100	0.0	+1.4
Southern Slope	6	1.97	87	−0.3	+2.2
Southern Plateau	9	0.56	58	−0.4	−2.1
Middle Plateau	13	0.12	17	−0.6	+0.7
Northern Plateau	10	0.65	32	−0.3	−0.9
North Pacific	9	1.69	50	−1.7	+3.5
Middle Pacific	5	0.22	35	−0.4	−2.1
South Pacific	4	T.	0	−0.1	−1.8

SNOW.

A measurable amount of snow fell in western New York, northern Michigan, northern Wisconsin, and northern Minnesota. Snow also fell in other portions of the States named but the amounts were generally too small to measure, A fall of snow so early in the season is a rather remarkable phenomenon; we therefore present a chart, No. VIII of this REVIEW, showing the amount and distribution of snowfall as reported by regular and voluntary observers.

HAIL.

The following are the dates on which hail fell in the respective States:

Arizona, 30. Colorado, 7, 8, 14, 15. Connecticut, 3. Georgia, 13, 14, 25. Idaho, 5, 12. Illinois, 7, 24, 25, 26. Indiana, 6, 7, 8, 24, 29. Iowa, 20, 22, 24. Kansas, 7, 9. Kentucky, 25. Louisiana, 7, 8. Massachusetts, 3. Michigan, 17, 24, 29. Minnesota, 2, 5, 6, 10. Missouri, 7, 17, 22, 24, 25. Montana, 1, 13. Nebraska, 15. Nevada, 14. New Hampshire, 3, 12, 30. New Jersey, 4, 29. New Mexico, 3, 13, 15, 16, 19. New York, 3, 14, 21, 25, 27, 29, 30. North Carolina, 6, 7, 25. North Dakota, 3. Ohio, 5, 7, 8. Oregon, 3, 30. Pennsylvania, 3, 8, 19, 29, 30. South Carolina, 7. South Dakota, 1. Tennessee, 8, 25, 26. Virginia, 5, 7, 25. Washington, 1, 5, 6, 30. West Virginia, 6, 7, 25. Wyoming, 5, 7, 13, 14, 17.

SLEET.

The following are the dates on which sleet fell in the respective States:

Indiana, 29; Michigan, 28, 29. Minnesota, 27, 28. New York, 30. North Dakota, 26, 27. Ohio, 27, 29, 30. Pennsylvania, 30. Wisconsin, 28.

LOCAL STORMS AND TORNADOES.

The month was unusually free from destructive local storms and tornadoes. The number of thunderstorms reported was

also much smaller than for the corresponding month a year ago. Forty-five lives were lost by lightning, as against 130 during the preceding month, and 41 during September, 1898.

Two short periods of thunderstorm activity in the Lake region and Ohio Valley prevailed, viz: On the 5–6th and again on the 7–8th. The storms were quite severe in portions of Ohio on the night of the 5th, and again on the night of the 7th.

Severe local storms occurred in Connecticut on the 26th, and in New Jersey on the 23d and again on the 29th.

WIND.

The maximum wind velocity at each Weather Bureau station for a period of five minutes is given in Table I, which also gives the altitude of Weather Bureau anemometers above ground.

Following are the velocities of 50 miles and over per hour registered during the month:

Maximum wind velocities.

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Amarillo, Tex	7	60	w.	Mount Tamalpais, Cal.	27	66	nw.
Basseterre, St. Kitts	8	62	sw.	Do.	28	63	nw.
Bismarck, N. Dak	27	51	nw.	Do.	29	62	nw.
Block Island, R. I.	11	54	e.	Do.	30	58	nw.
Fort Canby, Wash.	29	56	se.	New York, N. Y.	3	50	nw.
Hannibal, Mo	7	57	w.	Do.	11	64	e.
Huron, S. Dak	27	56	nw.	Pierre, S. Dak.	27	52	nw.
Mount Tamalpais, Cal.	2	50	n.	Williston, N. Dak.	1	60	nw.

HUMIDITY.

Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
	%			%	
New England	78	— 4	Missouri Valley	59	— 8
Middle Atlantic	76	— 1	Northern Slope	54	+ 1
South Atlantic	78	— 3	Middle Slope	54	— 4
Florida Peninsula	81	— 1	Southern Slope	57	— 5
East Gulf	71	— 6	Southern Plateau	34	—13
West Gulf	65	— 9	Middle Plateau	28	— 9
Ohio Valley and Tennessee	67	— 6	Northern Plateau	49	— 3
Lower Lake	70	— 4	North Pacific Coast	78	— 3
Upper Lake	78	+ 2	Middle Pacific Coast	56	—12
North Dakota	64	— 1	South Pacific Coast	67	+ 2
Upper Mississippi	68	— 4			

SUNSHINE AND CLOUDINESS.

The distribution of sunshine is graphically shown on Chart VII, and the numerical values of average daylight cloudiness, both for individual stations and by geographical districts, appear in Table I.

Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	4.9	—0.1	Missouri Valley	3.5	—0.5
Middle Atlantic	4.0	—0.8	Northern Slope	3.4	—0.6
South Atlantic	3.5	—1.3	Middle Slope	2.8	—0.4
Florida Peninsula	5.7	+0.2	Southern Slope	2.0	—1.6
East Gulf	2.7	—1.7	Southern Plateau	1.6	—0.7
West Gulf	2.9	—1.4	Middle Plateau	1.8	—0.7
Ohio Valley and Tennessee	3.8	—0.6	Northern Plateau	2.8	—1.3
Lower Lake	6.0	+1.2	North Pacific Coast	4.0	—0.9
Upper Lake	6.0	+0.9	Middle Pacific Coast	2.7	—0.1
North Dakota	3.5	—0.8	South Pacific Coast	2.0	—0.5
Upper Mississippi	3.9	—0.3			

ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table VII, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

Thunderstorms.—Reports of 2,203 thunderstorms were received during the current month as against 2,698 in 1898 and 4,943 during the preceding month.

The dates on which the number of reports of thunderstorms for the whole country were most numerous were: 7th, 258; 8th, 241; 3d, 178; 6th, 151.

Reports were most numerous from: Pennsylvania, 129; Florida, 111; Ohio, 107; Michigan, 104; New Mexico, 102.

Auroras.—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz, 14th to 22d.

The greatest number of reports were received for the following dates: 26th, 32; 25th, 27; 2d, 6; 27th, 5.

Reports were most numerous from: Minnesota, 13; Wisconsin, 12; Michigan, 10; Montana and North Dakota, 9.

In Canada.—Auroras were reported as follows: Sydney, 10th; Grand Manan, 25th; Yarmouth, 25th; Father Point, 30th; Quebec, 9th; White River, 26th, 27th; Minnedosa, 25th, 26th, 29th; Qu'Appelle, 8th; Medicine Hat, 1st, 25th, 26th; Prince Albert, 3d, 10th, 11th, 28th, 29th; Battleford, 29th, 30th.

Thunderstorms were reported as follows: St. Johns, 4th; Grand Manan, 3d, 4th; Yarmouth, 4th; Father Point, 3d; Quebec, 3d, 17th; Montreal, 4th, 12th; Toronto, 7th, 11th, 17th, 24th; White River, 2d, 4th, 12th; Ottawa, 18th; Port Stanley, 1st, 5th, 7th, 8th, 24th, 25th; Parry Sound, 5th; Port Arthur, 2d; Winnipeg, 4th; Barkersville, 21st; Minnedosa, 3d; Qu'Appelle, 3d; Medicine Hat, 1st; Swift Current, 1st, 17th; Banff, 12th, 29th; Edmonton, 13th; Kamloops, 12th; Victoria, 29th; Bermuda, 1st, 3d, 4th, 14th; Sable Island, 13th.

DESCRIPTION OF TABLES AND CHARTS.

By ALFRED J. HENRY, Chief of Division of Records and Meteorological Data.

Table I gives, for about 130 Weather Bureau stations making two observations daily and for about 20 others making only one observation, the data ordinarily needed for climatological studies, viz, the monthly mean pressure, the monthly means and extremes of temperature, the average conditions as to moisture, cloudiness, movement of the wind, and the departures from normals in the case of pressure, temperature, and precipitation, the total depth of snowfall, and the mean wet-bulb temperatures. The altitudes of the instruments above ground are also given.

Table II gives, for about 2,700 stations occupied by voluntary observers, the highest maximum and the lowest minimum

temperatures, the mean temperature deduced from the average of all the daily maxima and minima, or other readings, as indicated by the numeral following the name of the station; the total monthly precipitation, and the total depth in inches of any snow that may have fallen. When the spaces in the snow column are left blank it indicates that no snow has fallen, but when it is possible that there may have been snow of which no record has been made, that fact is indicated by leaders, thus (. . . .).

Table III gives, for 26 stations selected out of 113 that maintain continuous records, the mean hourly temperatures deduced from the Richard thermographs described and figured in the Report of the Chief of the Weather Bureau, 1891–92, p. 29.

Table IV gives, for 26 stations selected out of 104 that maintain continuous records, the mean hourly pressures as automatically registered by Richard barographs, except for Washington, D. C., where Foreman's barograph is in use. Both instruments are described in the Report of the Chief of the Weather Bureau, 1891–92, pp. 26 and 30.

Table V gives, for about 130 stations, the arithmetical means of the hourly movements of the wind ending with the respective hours, as registered automatically by the Robinson anemometer, in conjunction with an electrical recording mechanism, described and illustrated in the Report of the Chief of the Weather Bureau, 1891–92, p. 19.

Table VI gives, for all stations that make observations at 8 a. m. and 8 p. m., the four component directions and the resultant directions based on these two observations only and without considering the velocity of the wind. The total movement for the whole month, as read from the dial of the Robinson anemometer, is given for each station in Table I. By adding the four components for the stations comprised in any geographical division the average resultant direction for that division can be obtained.

Table VII gives the total number of stations in each State from which meteorological reports of any kind have been received, and the number of such stations reporting thunderstorms (T) and auroras (A) on each day of the current month.

Table VIII gives, for about 70 stations, the average hourly sunshine (in percentages) as derived from the automatic records made by two essentially different types of instruments, designated, respectively, the thermometric recorder and the photographic recorder. The kind of instrument used at each station is indicated in the table by the letter T or P in the column following the name of the station.

Table IX gives a record of rains whose intensity at some period of the storm's continuance equaled or exceeded the following rates:

Duration, minutes..	5	10	15	20	25	30	35	40	45	50	60	80	100	120
Rates pr. hr. (ins.)..	3.00	1.80	1.40	1.20	1.08	1.00	0.94	0.90	0.86	0.84	0.75	0.60	0.54	0.50

In the northern part of the United States, especially in the colder months of the year, rains of the intensities shown in the above table seldom occur. In all cases where no storm of sufficient intensity to entitle it to a place in the full table has occurred, the greatest rainfall of any single storm has been given, also the greatest hourly fall during that storm.

Table X gives the record of excessive precipitation at all stations from which reports are received.

Table XI gives, for about 30 stations furnished by the Canadian Meteorological Service, Prof. R. F. Stupart, director, the means of pressure and temperature, total precipitation and depth of snowfall, and the respective departures from normal values, except in the case of snowfall.

NOTES EXPLANATORY OF THE CHARTS.

Chart I, tracks of centers of high areas, and Chart II, tracks of centers of low areas, are constructed in the same way. The roman numerals show number and chronological order of highs (Chart I) and lows (Chart II). The figures within the circles show the days of the month; the letters *a* and *p* indicate, respectively, the 8 a. m. and 8 p. m., seventy-fifth meridian time, observations. Within each circle is also given (Chart I) the highest barometric reading and (Chart II) the lowest pressure at or near the center at that time.

Chart III.—Total precipitation. The scale of shades showing the depth of rainfall is given on the chart itself. For isolated stations the rainfall is given in inches and tenths, when appreciable; otherwise, a "trace" is indicated by a capital T, and no rain at all, by 0.0.

Chart IV.—Sea-level pressure, temperature, and resultant surface winds. The wind directions on this Chart are the computed resultants of observations at 8 a. m. and 8 p. m., daily; the resultant duration is shown by figures attached to each arrow. The temperatures are the means of daily maxima and minima and are reduced to sea level. The pressures are the means of 8 a. m. and 8 p. m. observations, daily, and are reduced to sea level and to standard gravity. The reduction for 30 inches of the mercurial barometer, as formerly shown by the marginal figures for each degree of latitude, has already been applied.

Chart V.—Hydrographs for seven principal rivers of the United States.

Chart VI.—Surface temperatures; maximum, minimum, and mean. Lines of equal monthly mean temperature in red; lines of equal maximum temperature in black; and lines of equal minimum temperature (dotted) also in black.

Chart VII.—Percentage of sunshine. The average cloudiness at each Weather Bureau station is determined by numerous personal observations during the day. The difference between the observed cloudiness and 100, it is assumed, represents the percentage of sunshine, and the values thus obtained have been used in preparing Chart VII.

Chart VIII.—The total snowfall. This is based on the reports from regular and voluntary observers, and shows the depth of the snowfall during the month in inches. In general, the depth is shown by lines inclosing areas of equal snowfall, but in special cases figures are also given.

Chart IX.—Sea-level pressure, temperature, and resultant surface winds, West Indian stations. See explanation under Chart IV.

Chart X.—West Indian hurricane tracks.

Chart XI.—Path of totality during eclipse of May 28, 1900.

TABLE I.—*Climatological data for Weather Bureau Stations, September*, 1899.

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.										Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.					Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Mean actual, 8 a. m. and 8 p. m. + 2.	Mean reduced.	Departure from normal.	Mean max. and min. + 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.					Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.					
New England.							63.6	— 0.3											78	3.89	+ 0.7									4.9	
Eastport	76	69	74	29.96	30.05	+ .02	54.9	— 0.9	69	3	61	42	15	49	22	51	48	82	2.03	— 1.2	11	7,403	sw.	33	nw.	6	7	9	14	6.5	
Portland, Me.	103	81	89	29.91	30.01	— .04	57.6	— 2.1	75	8	65	40	24	50	21	53	50	78	4.47	+ 1.4	11	5,550	sw.	28	ne.	20	13	7	10	5.1	
Northfield	872	15	65	29.11	30.04	— .03	54.3	— 1.7	80	18	65	36	16	43	43	50	47	78	4.19	+ 1.4	13	6,948	s.	38	n.	6	8	6	16	6.2	
Boston	125	115	181	29.92	30.06	— .00	62.0	— 0.4	82	19	70	44	15	54	25	56	53	76	5.09	+ 2.2	7	7,486	sw.	34	ne.	20	11	8	11	4.0	
Nantucket	14	43	54	30.05	30.06	— .03	62.2	— 0.5	77	6	68	49	24	57	17	58	55	78	1.88	— 1.4	9	7,570	sw.	35	e.	11	12	12	6	4.8	
Woods Hole	22	11	57	30.04	30.06	.00	63.5	+ 0.5	76	6	69	48	*	58	20	58	56	80	3.53	+ 0.4	11	9,755	w.	40	se.	20	14	7	9	4.7	
Vineyard Haven	.....	20	55	.....	.....	.....	64.1	— 0.4	81	1	71	47	15	57	20	.....	.....	.....	3.15	— 0.7	8	6,059	sw.	45	e.	11	12	13	5	4.5	
Block Island	27	11	48	30.03	30.06	— .01	63.4	— 0.2	79	6	69	48	15	58	16	59	55	77	4.92	+ 2.0	10	11,112	sw.	54	e.	11	14	12	4	3.6	
Narragansett	.....	10	....	.....	.....	.....	61.4	— 0.8	80	1	70	40	*	53	26	..	.....	....	6.30	+ 3.1	10	.....	s.	....	.....	...	21	4	5	....	
New Haven	107	118	140	29.95	30.06	— .02	62.2	— 1.3	82	8	70	41	15	54	25	57	54	77	3.33	— 0.4	9	6,107	sw.	27	nw.	6	14	9	7	4.4	
Mid. Atlan. States.							66.1	— 0.9											76	4.24	+ 0.4									4.9	
Albany	97	84	113	29.95	30.06	.00	61.4	— 1.7	85	3	71	40	16	52	31	55	51	73	6.33	+ 2.9	9	5,637	s.	35	se.	24	9	11	10	5.7	
Binghamton	875	79	90	.....	.....	.....	59.2	— 1.8	88	3	70	32	16	48	44	....	....	....	1.45	— 1.9	10	4,666	nw.	29	s.	24	5	10	15	6.8	
New York	314	313	346	29.73	30.06	— .02	63.2	— 0.7	84	8	72	46	27	58	20	60	57	77	5.89	+ 2.2	10	9,770	nw.	64	e.	11	14	8	8	4.4	
Harrisburg	377	94	104	.....	.....	.....	64.2	— 0.2	86	3	73	41	30	55	27	....	...	..	4.25	+ 0.2	10	4,271	se.	32	nw.	8	14	9	7	4.6	
Philadelphia	117	168	184	29.93	30.07	— .02	67.0	— 0.1	87	8	75	45	30	59	23	60	56	78	3.66	+ 0.4	9	6,285	sw.	25	nw.	29	14	9	7	4.1	
Atlantic City	52	68	76	30.01	30.06	.00	65.6	— 1.1	88	6	72	42	30	59	20	62	60	81	8.19	+ 4.7	8	7,270	s.	29	nw.	29	14	13	3	3.5	
Cape May	24	52	70	30.05	30.07	.....	67.1	— 1.0	88	6	72	48	30	62	19	62	....	...	2.36	— 1.6	6	8,848	s.	33	s.	28	18	9	3	3.1	
Baltimore	123	68	82	29.93	30.06	— .02	67.0	— 0.9	94	6	76	42	30	58	29	60	56	72	7.09	+ 3.2	10	3,362	se.	20	nw.	8	17	8	5	3.5	
Washington	112	59	76	29.95	30.07	— .02	65.8	— 2.0	94	6	76	41	30	55	31	60	58	79	6.14	+ 2.4	10	4,145	s.	34	nw.	25	19	6	5	3.1	
Cape Henry	.....	5	34	.....	.....	.....	72.0	+ 0.2	96	6	78	51	28	66	26	....	....	....	0.59	— 4.0	6	8,629	se.	37	nw.	25	19	11	0	2.8	
Lynchburg	685	83	88	29.34	30.07	.00	67.0	— 2.0	98	6	78	40	28	56	32	60	57	79	4.54	+ 0.7	10	2,008	s.	26	w.	8	19	8	3	3.4	
Norfolk	92	102	111	29.97	30.07	.00	71.6	+ 0.5	98	6	79	51	28	64	28	64	61	74	0.37	— 4.2	7	5,733	se.	33	nw.	29	24	4	2	2.8	
Richmond	144	98	105	.....	.....	.....	69.9	.....	100	6	80	45	30	60	28	....	....	....	6.21	.....	10	3,634	se.	23	se.	25	15	9	6	3.8	
S. Atlantic States.							74.0	0.0											78	2.27	— 3.1									3.5	
Charlotte	773	68	76	29.23	30.06	.00	70.4	— 0.7	98	6	81	44	27	60	30	62	58	73	2.02	— 1.4	8	3,779	ne.	22	nw.	25	14	11	5	3.9	
Hatteras	11	17	36	30.04	30.05	+ .01	74.9	+ 1.2	88	9	79	60	28	70	13	70	68	81	0.61	— 5.8	8	8,093	n.	38	w.	9	19	10	1	3.0	
Kittyhawk	9	12	30	30.03	30.04	+ .01	73.0	— 0.4	93	6	78	53	28	68	22	69	67	88	0.23	— 4.4	3	9,683	ne.	....	.....	...	21	9	3	2.9	
Raleigh	375	93	101	29.67	30.06	— .02	70.4	— 0.1	100	6	81	45	28	60	28	63	60	76	2.68	— 1.0	10	3,652	ne.	37	nw.	25	23	6	1	2.3	
Wilmington	78	82	90	29.97	30.05	+ .01	73.2	— 0.4	94	6	81	50	28	65	24	67	65	82	0.12	— 6.3	4	4,743	ne.	21	ne.	16	15	12	3	3.7	
Charleston	48	14	92	30.01	30.06	+ .03	76.9	+ 0.9	95	7	83	57	27	71	20	69	66	74	1.77	— 4.8	5	7,201	ne.	28	e.	16	11	17	2	4.0	
Columbia	.....	5	....	.....	.....	.....	73.5	— 0.3	97	7	84	45	28	63	35	....	....	....	3.13	— 1.0	9	.....	ne.	....	.....	...	14	11	5	4.0	
Augusta	180	89	103	29.85	30.04	+ .02	74.2	— 0.2	95	7	84	46	28	64	31	66	62	73	2.81	— 1.1	8	3,768	ne.	32	e.	7	18	8	4	3.4	
Savannah	65	79	89	29.96	30.02	— .01	76.4	+ 0.6	94	7	85	53	27	68	23	70	67	81	4.22	— 1.9	4	4,824	e.	24	e.	17	22	5	3	2.8	
Jacksonville	43	69	84	29.96	30.01	+ .02	77.4	— 0.2	93	10	86	54	27	69	23	71	69	80	5.10	— 3.3	8	4,730	ne.	24	ne.	15	13	13	4	4.6	
Florida Peninsula.							80.7	+ 0.3											81	7.63	— 0.1									5.7	
Jupiter	28	13	30	29.93	29.96	.00	80.2	+ 0.6	91	18	87	70	13	74	20	75	74	83	11.27	+ 1.6	23	5,722	ne.	29	ne.	2	8	13	9	5.5	
Key West	22	43	50	29.94	29.96	+ .02	82.8	+ 0.3	90	22	87	71	16	78	17	76	74	76	3.27	— 4.2	20	4,935	ne.	26	ne.	28	6	19	5	5.4	
Tampa	36	60	67	29.93	29.97	— .01	79.2	— 0.4	92	6	87	62	27	71	23	73	71	83	8.35	+ 2.2	15	3,893	ne.	23	s.	16	4	20	6	6.2	
East Gulf States.							75.2	— 0.7											71	1.20	— 3.0									2.7	
Atlanta	1,174	139	156	28.84	30.06	— .01	71.6	+ 0.1	96	7	81	43	30	62	26	62	56	65	2.27	— 1.4	4	6,404	nw.	27	nw.	26	17	11	2	2.9	
Macon	370	....	....	.....	.....	.....	73.8	.....	97	7	85	45	27	63	35	....	....	....	1.61	.....	5	4,551	ne.	28	nw.	25	13	16	1	3.4	
Pensacola	56	78	90	.....	.....	.....	77.0	— 0.5	95	11	85	55	22	69	26	....	...	..	0.91	— 3.9	5	6,094	ne.	30	sw.	25	22	6	2	2.6	
Mobile	57	88	96	29.98	30.04	+ .05	76.0	— 0.8	95	3	86	50	27	66	30	68	65	77	1.22	— 3.9	7	4,344	n.	25	n.	25	26	3	1	1.5	
Montgomery	221	100	112	29.80	30.04	+ .02	74.9	— 0.7	96	4	86	45	28	64	35	65	61	71	0.66	— 2.3	3	3,486	n.	26	nw.	25	20	8	2	2.3	
Meridian	373	84	94	.....	.....	.....	71.9	— 1.1	96	5	84	39	27	59	38	....	....	....	0.34	— 3.0	3	3,002	n.	21	nw.	25	24	5	1	2.1	
Vicksburg	247	65	73	29.77	30.03	+ .01	74.0	— 1.3	96	5	84	49	30	64	27	65	61	71	2.10	— 1.4	6	3,954	n.	26	se.	5	23	3	4	2.4	
New Orleans	54	112	120	29.98	30.04	+ .07	77.7	— 0.6	95	4	85	57	30	71	22	69	65	71	0.35	— 4.2	5	5,807	n.	31	n.	25	24	6	0	2.0	
Port Eads	.....	97	....	.....	.....	.....	78.8	— 1.0	90	*	84	66	*	74	14	73	....	....	1.71	— 4.3	9	.....	ne.	40	e.	16	8	12	10	4.7	
West Gulf States.							76.3	+ 0.3											65	1.27	— 2.7									2.9	
Shreveport	249	77	84	29.79	30.05	+ .04	76.0	+ 0.5	101	4	88	49	30	64	32	63	56	60	0.50	— 3.2	2	4,204	se.	25	ne.	10	23	1	6	2.4	
Fort Smith	457	74	82	29.56	30.04	+ .05	73.0	+ 0.7	102	5	86	40	29	60	37	61	54	58	0.34	— 3.2	2	4,382	e.	25	w.	25	16	12	2	3.5	
Little Rock	357	93	100	29.70	30.08	+ .05	72.4	— 0.5	98	5	83	42	30	61	32	62	57	65	2.88	— 0.3	4	3,966	nw.	30	nw.	25	20	8	2	2.6	
Corpus Christi	20	42	50	29.99	30.01	+ .04	78.8	0.0	92	25	84	65	36	74	25	72	69	75	2.48	— 2.3	5	7,063	se.	30	e.	1	19	7	4	2.7	
Fort Worth	670	106	114	.....	.....	.....	76.5	.....	98	5	88	52	27	64	33	....	....	....	1.02	.....	1	5,490	sw.	16	nw.	17	27	2	1	2.4	
Galveston	54	85	96	29.96	30.01	+ .05	79.7	+ 0.2	92	4	85	67	27	73	14	70	66	68	1.85	— 4.4	6	5,227	se.	24	se.	2	19	7	4	3.4	
Palestine	510	54	61	29.50	30.04	+ .03	76.2	+ 0.5	98	13	89	43	27	64	39	64	58	64	0.28	— 3.0	2	3,836	n.	19	ne.	29	18	9	3	3.2	
San Antonio	704	95	104	29.29	30.01	+ .04	78.0	+ 0.5	96	10	90	56	27	66	30	66	60	64	0.57	— 2.8	3	5,100	se.	30	se.	17	20	6	4	2.9	
Ohio Val. & Tenn.							68.5	— 0.1											67	2.03	— 1.0									3.8	
Chattanooga	762	106	112	29.28	30 08	+ .02	70.8	+ 0.1	97	6	82	41	28	60	35	61	56	67	1.42	— 2.3	5	4,129	w.	26	nw.	25	21	8	1	2.9	
Knoxville	1,004	10	88	29.03	30.08	.00	70.0	+ 0.7	99	7	82	38	27	58	36	60	56	69	1.68	— 1.0	7	4,080	ne.	31	nw.	25	14	12	4	4.0	
Memphis	399	140	154	29.66	30.08	+ .04	72.6	+ 0.5	96	5	82	39	30	63	33	63	57	65	0.52	— 2.6	3	3,354	nw.	28	ne.	10	23	5	2	2.5	
Nashville	545	128	134	29.51	30.08	+ .04	70.5	— 0.2	98	5	82	38	30	59	35	61	55	66	1.50	— 2.6	5	3,990	nw.	36	se.	6	21	6	3	2 4	
Lexington	990	75	102	.....	.....	.....	67.6	— 0.5	98	6	78	32	30	57	31	....	....	....	1.90	— 1.5	5	6,338	nw.	68	w.	8	13	11	6	4.2	
Louisville	525	114	136	29.51	30.07	+ .01	69.8	+ 0.4	102	6	81	36	30	58	35	59	53	63	0.89	— 1.9	5	4,321	sw.	37	nw.	24	18	6	6	3.2	
Evansville	434	72	82	.....	.....	.....	70.2	.....	98	6	80	33	30	60	35	....	....	....	1.02	.....	5	4,514	s.	34	sw.	24	18	10	2	2.7	
Indianapolis	823	154	164	29.20	30.07	+ .02	65.7	— 0.3	98	6	76	30	30	56	30	57	52	67	2.54	— 0.4	9	6,435	nw.	43	s.	24	11	10	9	5.1	
Cincinnati	628	152	157	29.40	30.07	+ .02	68.1	0.0	99	6	78	35	30	58	32	58	51	62	2.18	— 0.2	8	5,175	nw.	28	nw.	8	16	10	4	3.6	
Columbus	824	87	100	29.18	30.05	+ .01	65.7	— 0.4	98	5	77	33	30	55	38	56	51	68	2.01	— 0.6	10	5,358	nw.	29	sw.	24	15	8	7	4.4	
Pittsburg	842	116	123	29.16	30.05	— .02	65.4	— 1.3	92	5	75	39	30	56	32	57	52	69	2.66	+ 0.1	11	4,317	nw.	23	s.	28	13	9	8	4.7	
Parkersburg	638	77	84	29.41	30.08	— .02	66.4	— 0.4	98	5	78	35	30	55	42	58	53	72	4.88	+ 1.7	11	3,863	se.	35	s.	7	11	10	9	4.8	
Elkins	1,940	41	51	.....	.....	.....	59.7	.....	90	7	72	26	30	47	41	....	....	....	5.01	.....	12	2,379	w.	27	sw.	8	10	9	11	5.5	
Lower Lake Region.							60.9	— 2.3											70	2.72	— 0.2									5.0	
Buffalo	768	178	206	29.20	30.02	— .02	60.2	— 1.9	87	7	68	38	30	52	38	55	51	76	4.48	+ 1.2	13	9,679	w.	48	s.	25	5	15	10	6.8	T.
Oswego	335	76	87	29.65	30.01	— .05	59.8	— 1.9	87	17	68	39	30	52	38	53	48	69	3.53	+ 0.7	12	7,817	s.	30	n.	3	8	10	12	6.2	0.1
Rochester	523	81	90	29.47	30.03	— .01	59.7	— 2.3	91	17	69	37	30	50	40	53	48	72	2.54	+ 0.2	13	5,308	sw.	24	w.	30	12	8	10	5.1	T.
Erie	714	92	102	29.29	30.05	.00	61.6	— 2.0	91	7	69	37	30	54	34	55	50	71	3.76	— 0.2	13	8,110	n.	31	nw.	30	6	10	14	6.5	
Cleveland	762	190	201	29.23	30.03	— .03	61.9	— 1.9	91	7	69	38	30	55	35	55	50	69	1.51	— 2.0	12	10,774	n.	47	n.	25	10	11	9	5.5	T.
Sandusky	629	62	74	29.37	30.04	— .01	62.8	— 2.3	94	7	70	36	30	55	33	55	50	66	1.07	— 1.8	14	6,500	sw.	30	n.	25	9	6	15	6.5	
Toledo	628	123	127	29.38	30.06	+ .02	61.2	— 2.7	93	7	70	30	30	52	34	54	49	69	2.67	+ 0.3	12	6,399	nw.	32	sw.	28	8	12	10	5.6	
Detroit	730	160	166	29.26	30.04	— .01	59.8	— 3.1	95	7	68	30	30	52	34	53	49	72	2.18	— 0.3	11	6,527	sw.	37	sw.	28	9	9	12	5.8	
Upper Lake Region.							56.2	— 2.8											73	3.24	— 0.2									6.0	
Alpena	609	61	65	29.39	30.05	+ .04	53.9	— 3.3	88	2	62	29	23	46	31	50	48	85	2.69	— 1.1	13	5,580	nw.	33	w.	28	5	14	11	6.3	0.5
Escanaba	612	43	57	29.39	30.06	+ .11	53.0	— 3.7	86	2	62	29	30	44	29	49	46	79	2.89	— 0.7	16	7,245	nw.	29	n.	29	4	10	16	7.1	T.
Grand Haven	628	55	64	29.37	30.04	+ .02	57.7	— 3.2	86	2	67	33	30	49	33	53	49	77	4.06	+ 0.5	13	6,383	nw.	32	sw.	28	12	11	7	4.9	T.
Marquette	734	67	95	29.23	30.02	+ .03	52.6	— 4.2	87	2	60	30	30	46	26	49	46	82	3.90	0.0	17	7,826	nw.	40	se.	4	1	18	16	7.4	6.0
Port Huron	639	70	108	29.37	30.06	+ .03	58.9	— 2.3	94	7	67	30	30	51	38	53	50	76	4.73	+ 2.2	12	7,737	nw.	38	s.	28	9	10	11	5.8	
Sault Ste. Marie	614	40	60	29.36	30.03	+ .02	50.8	— 4.7	84	2	59	28	30	43	30	47	45	88	4.47	0.0	11	6,811	nw.	44	nw.	12	7	9	14	6.3	T.
Chicago	824	241	274	29.19	30.06	+ .03	62.7	— 1.5	98	5	70	32	30	56	28	56	51	71	2.39	— 0.4	10	12,167	ne.	47	w.	28	9	11	10	5.4	
Milwaukee	681	124	142	29.34	30.07	+ .04	61.1	— 0.1	93	2	69	30	30	53	30	54	49	70	3.04	+ 0.2	10	8,656	ne.	36	sw.	28	5	6	19	7.2	T.
Green Bay	617	49	57	29.40	30.06	+ .02	56.7	— 3.8	90	2	67	25	30	47	32	50	47	77	2.16	— 0.9	7	6,124	n.	31	w.	5	10	13	7	5.2	
Duluth	702	95	106	29.29	30.05	+ .07	55.1	— 1.1	79	9	62	29	29	48	23	49	45	74	2.05	— 1.8	10	6,645	ne.	36	nw.	28	11	13	6	4.9	T.
North Dakota.							57.0	+ 0.7											64	0.54	— 0.8									3.5	
Moorhead	985	54	60	29.04	30.05	+ .09	56.1	— 0.4	92	1	68	22	29	44	41	48	43	72	1.54	— 0.6	6	7,704	se.	42	nw.	27	13	11	6	4.4	1.4
Bismarck	1,674	16	29	28.28	30.04	+ .09	57.8	+ 0.8	95	1	72	25	29	43	42	48	40	60	0.06	— 1.1	2	7,254	nw.	51	nw.	27	23	6	1	2.7	
Williston	1,872	15	31	28.05	30.02	+ .07	57.2	+ 1.7	88	1	73	23	29	42	45	47	39	59	0.01	— 0.8	1	7,162	n.	60	nw.	1	23	5	2	3.4	

TABLE I.—*Climatological data for Weather Bureau Stations, September*, 1899—Continued.

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.									Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.				Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Mean actual, 8 a. m. and 8 p. m. + 2.	Mean reduced.	Departure from normal.	Mean max. and min. + 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.				Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.				
Upper Miss. Valley.							64.2	— 0.8										68	1.88	— 1.3								3.0	
Minneapolis	.....	99	208	.....	.....	.....	59.4	— 2.8	89	4	69	29	30	50	34	....	....	....	1.31	— 1.2	10	8,769	n.	48	e.	6	11	10	9	....	
St. Paul	837	114	124	29.14	30.04	+ .05	59.0	— 0.8	88	4	69	28	30	49	35	51	46	69	1.21	— 1.8	11	5,698	nw.	38	nw.	28	13	9	8	4.7	
La Crosse	720	70	78	.....	.....	.....	59.7	— 1.9	87	5	70	24	30	49	34	....	....	....	1.06	— 3.2	5	4,753	se.	27	w.	28	10	12	8	5.5	T.
Davenport	606	71	79	29.41	30.05	+ .02	64.4	— 0.3	99	5	75	28	30	54	33	56	51	70	0.82	— 2.4	6	4,909	sw.	28	nw.	28	15	7	8	4.2	
Des Moines	867	84	88	29.16	30.08	+ .08	64.0	— 0.1	99	5	76	26	30	52	38	54	49	65	1.17	— 2.0	8	5,668	ne.	35	sw.	6	13	10	7	4.3	
Dubuque	698	101	109	29.32	30.07	+ .05	62.4	— 0.8	96	5	73	24	30	52	34	53	48	66	0.99	— 3.1	8	5,431	nw.	34	nw.	12	12	13	5	4.6	
Keokuk	614	64	78	29.42	30.07	+ .05	65.2	— 1.2	99	6	75	30	29	55	32	56	51	68	4.32	+ 0.8	9	4,747	sw.	28	w.	28	19	7	4	3.0	
Cairo	359	87	93	29.69	30.08	+ .05	70.1	+ 0.2	97	6	80	36	30	60	32	62	58	75	2.25	— 0.3	6	4,856	s.	36	n.	10	15	13	2	3.1	
Springfield, Ill.	644	82	92	29.39	30.07	+ .03	65.4	— 1.0	99	5	76	31	30	55	35	56	51	69	3.33	+ 0.1	8	5,709	n.	25	sw.	24	15	9	6	3.9	
Hannibal	534	75	107	.....	.....	.....	66.0	— 0.7	101	6	77	32	30	55	35	....	....	....	2.91	+ 0.4	9	5,569	sw.	57	w.	7	20	6	4	3.1	
St. Louis	567	111	210	29.46	30.07	+ .04	70.1	+ 0.7	102	5	80	37	30	60	31	59	52	60	1.27	— 1.8	5	6,928	s.	32	w.	24	19	7	4	2.9	
Missouri Valley.							65.3	— 0.2										59	1.08	— 1.4								3.5	
Columbia	783	4	84	.....	.....	.....	67.1	— 1.4	103	5	81	28	30	53	38	....	....	....	3.55	0.0	7	4,886	nw.	29	nw.	7	17	9	4	3.5	
Kansas City	963	78	95	29.06	30.07	+ .07	68.2	+ 0.7	99	5	79	35	29	58	33	57	50	58	1.66	— 1.8	3	5,733	nw.	32	nw.	24	21	4	5	2.6	
Springfield, Mo.	1,324	100	103	28.69	30.07	+ .06	69.0	+ 1.3	99	6	80	37	29	58	32	58	52	63	1.06	— 3.0	3	6,683	se.	32	n.	25	24	3	3	2.2	
Topeka	.....	81	....	.....	.....	.....	67.8	— 0.9	100	5	80	35	29	56	37	....	....	....	1.57	— 1.2	6	.....	s.	....	.....	...	16	10	4	3.1	
Lincoln	1,199	74	84	28.78	30.04	+ .04	66.7	+ 0.6	101	5	80	27	29	53	43	54	46	57	0.39	— 1.5	3	7,612	se.	45	nw.	24	19	7	4	3.4	
Omaha	1,105	115	123	28.88	30.03	+ .03	66.4	+ 1.6	99	5	78	33	29	55	35	56	50	65	0.53	— 2.4	2	5,855	n.	40	n.	24	12	13	5	4.5	
Sioux City	1,139	96	164	.....	.....	.....	62.6	— 2.6	99	6	76	25	29	49	43	....	....	....	0.26	— 0.9	2	9,242	s.	46	nw.	27	18	7	5	3.5	
Pierre	1,572	50	62	28.37	30.02	+ .03	63.2	— 0.5	104	1	77	29	29	49	41	50	39	50	1.51	+ 0.5	3	7,950	se.	52	nw.	27	14	12	4	3.7	
Huron	1,306	56	67	28.65	30.05	+ .05	58.8	— 1.3	93	1	73	18	29	44	45	48	41	62	0.29	— 1.1	5	8,668	nw.	56	nw.	27	13	12	5	4.1	
Yankton	1,234	52	58	.....	.....	.....	63.0	+ 0.9	96	6	76	24	29	50	41	....	....	....	0.02	— 2.8	2	6,075	nw.	37	sw.	16	15	11	4	4.2	
Northern Slope.							60.9	+ 2.9										54	0.37	— 0.6								3.4	
Havre	2,494	46	47	27.40	29.98	+ .02	58.8	— 3.9	89	10	74	28	28	44	46	49	41	61	0.20	— 1.0	4	6,981	sw.	44	nw.	27	19	9	2	3.5	
Miles City	2,371	42	50	27.53	29.98	.00	62.4	+ 2.4	94	*	79	32	28	46	42	52	45	62	0.04	— 0.7	2	4,309	se.	48	n.	3	21	8	1	3.3	
Helena	4,108	88	93	25.95	30.07	+ .08	59.8	+ 4.0	86	11	72	35	16	47	36	47	33	43	0.64	— 0.5	3	5,780	sw.	43	sw.	12	16	5	9	4.0	
Kalispell	2,964	45	51	27.01	30.07	.....	55.0	.....	77	26	67	36	29	43	36	48	43	69	2.75	.....	7	4,042	nw.	26	se.	30	13	12	5	4.1	
Rapid City	3,251	46	50	26.67	29.96	.00	62.8	+ 1.4	100	3	76	33	29	49	42	50	38	48	0.83	+ 0.3	3	4,627	nw.	36	nw.	27	22	7	1	2.4	
Cheyenne	6,084	58	60	24.14	30.00	+ .05	59.4	+ 3.2	89	5	75	29	28	44	45	45	28	40	0.07	— 0.8	3	6,377	nw.	38	w.	13	16	11	3	3.7	
Lander	5,372	28	36	24.76	30.05	+ .08	58.6	+ 2.9	86	3	76	28	28	41	49	45	31	47	0.54	— 0.2	3	2,934	sw.	34	s.	1	20	8	2	2.4	
North Platte	2,836	43	52	27.14	30.03	+ .03	64.7	+ 2.3	99	5	80	28	29	50	46	52	45	58	0.28	— 1.0	3	5,907	se.	35	nw.	24	15	12	3	3.8	
Middle Slope.							65.6	+ 1.2										54	1.69	0.0								2.8	
Denver	5,290	79	151	24.84	30.01	+ .07	65.0	+ 3.1	97	5	80	35	28	50	43	48	32	39	0.20	— 0.6	1	5,185	s.	43	w.	13	22	6	2	3.4	
Pueblo	4,682	74	81	25.38	30.00	+ .07	65.9	+ 0.7	98	4	82	37	29	50	46	50	37	47	0.59	+ 0.2	3	4,329	nw.	45	w.	14	19	5	6	3.6	
Concordia	1,398	42	47	28.58	30.04	+ .06	69.0	+ 1.2	101	5	82	33	29	56	41	55	48	58	1.49	— 0.9	6	5,036	s.	25	nw.	7	20	4	6	3.4	
Dodge	2,504	44	52	27.46	30.01	+ .06	69.5	+ 1.9	98	6	83	42	29	56	40	57	50	61	1.71	+ 0.4	5	8,046	s.	42	s.	14	22	5	3	3.2	
Wichita	1,351	78	85	28.64	30.05	+ .08	70.0	0.0	99	5	82	39	29	58	33	58	51	61	4.75	+ 2.1	5	5,897	s.	27	nw.	28	20	7	3	2.5	
Oklahoma	1,218	54	62	28.77	30.04	+ .07	72.2	+ 0.6	96	6	84	42	29	60	36	60	53	59	1.38	— 1.5	6	5,135	s.	24	s.	22	24	5	1	1.7	
Southern Slope.							72.2	+ 1.2										57	3.26	+ 1.0								2.0	
Abilene	1,749	45	54	28.25	30.03	+ .05	76.3	+ 1.7	97	24	88	52	29	65	36	61	52	52	0.44	+ 2.0	1	5,740	se.	40	nw.	16	25	3	2	1.7	
Amarillo	3,691	54	61	26.35	30.03	+ .06	68.2	+ 0.8	91	5	80	44	29	57	33	57	51	62	6.09	+ 4.0	6	10,523	s.	60	w.	7	21	6	3	2.4	
Southern Plateau.							77.6	+ 3.9										34	0.48	— 0.2								1.6	
El Paso	3,767	10	110	26.21	29.93	+ .04	75.3	+ 2.2	100	2	89	53	22	62	39	57	41	37	0.64	— 0.5	2	6,010	e.	43	nw.	8	24	6	0	1.6	
Santa Fe	6,998	47	50	23.40	30.00	+ .04	63.2	+ 3.3	86	2	74	37	17	52	29	48	33	42	1.39	— 0.1	6	3,966	se.	25	se.	24	23	3	4	2.6	
Flagstaff	6,885	12	25	23.47	30.05	.....	60.1	.....	84	26	78	33	17	42	47	48	....	....	0.14	.....	4	.....	ne.	....	.....	...	11	11	8	....	
Phenix	1,076	47	57	28.71	29.79	— .03	86.5	+ 5.7	112	2	101	60	17	72	39	63	47	31	0.37	— 0.2	2	2,965	e.	19	n.	28	21	9	0	2.1	
Yuma	139	16	50	29.62	29.76	— .02	88.2	+ 3.8	112	2	104	63	16	72	41	69	58	46	0.00	— 0.2	0	3,743	w.	21	w.	14	27	2	1	1.1	
Independence	3,907	10	58	26.01	29.84	— .01	74.6	+ 4.6	94	2	89	51	16	60	33	51	19	13	T.	— 0.1	0	5,373	nw.	36	w.	4	27	3	0	0.7	
Middle Plateau.							63.8	+ 2.5										28	0.01	— 0.5								1.8	
Carson City	4,720	82	92	25.36	30.01	+ .10	62.9	+ 3.6	90	19	81	35	16	45	48	48	31	37	0.00	— 0.3	0	3,677	w.	36	sw.	2	24	4	2	1.2	
Winnemucca	4,340	59	70	25.75	30.03	+ .10	61.3	+ 1.2	89	11	81	30	15	42	53	45	23	27	0.02	— 0.3	1	5,563	sw.	47	sw.	1	21	6	3	2.3	
Cedar City	5,850	36	47	24.36	29.97	.....	69 0	.... ..	86	11	81	41	15	57	31	48	21	19	T.	.....	0	4,670	se.	22	sw.	3	23	7	0	1.8	
Salt Lake City	4,360	105	110	25.69	29.99	+ .05	67.1	+ 2.8	91	12	80	46	15	54	39	50	30	28	T.	— 0.9	0	3,748	se.	28	nw.	5	26	4	0	1.3	
Grand Junction	4,608	43	50	25.43	29.95	.....	70.0	.....	98	5	86	46	23	54	39	50	31	29	0.31	.....	1	3,798	se.	34	se.	14	22	6	2	2.3	
Northern Plateau.							63.7	+ 4.5										49	0.54	— 0.2								2.8	
Baker City	3,470	49	55	26.52	30.04	+ .06	61.0	+ 5.2	91	11	77	33	8	45	42	47	32	41	0.12	— 0.6	3	4,750	s.	22	se.	30	19	7	4	2.8	
Boise	2,736	61	68	27.22	30.01	+ .03	65.1	+ 4.3	95	12	82	40	6	49	44	52	41	47	0.28	— 0.2	2	2,440	w.	18	w.	13	25	5	0	1.8	
Pocatello	4,482	48	56	25.58	30.02	+ .04	62.3	+ 4.8	90	12	79	32	8	45	44	48	31	36	T.	— 0.7	0	6,592	s.	36	w.	3	22	8	0	2.4	
Spokane	1,943	99	107	28.04	30.05	+ .07	62.5	+ 4.4	89	11	76	40	28	48	37	52	43	58	1.07	+ 0.1	6	3,223	ne.	25	s.	12	17	6	7	3.8	
Walla Walla	1,018	65	73	28.98	30.04	+ .04	67.7	+ 3.8	94	11	81	46	8	54	34	59	52	61	1.24	+ 0.3	5	3,119	s.	25	w.	4	22	6	2	3.0	
N. Pac. Coast Reg.							60.0	+ 2.4										78	1.69	— 1.7								4.0	
Fort Canby	179	10	34	29.90	30.09	+ .08	58.9	+ 1.9	85	24	65	48	30	53	37	55	53	87	3.19	— 0.5	9	6,325	n.	56	se.	29	13	8	9	5.0	
Neah	50	7	34	30.05	30.10	+ .09	55.0	— 0.2	69	27	61	42	30	49	20	53	52	89	2.21	— 5.1	7	3,321	w.	30	w.	29	13	5	12	5.2	
Port Crescent	256	15	20	.....	.....	.....	56.2	+ 3.4	82	11	67	39	18	46	37	....	....	....	0.79	— 2.6	7	2,888	w.	18	w.	12	16	9	5	3.3	
Seattle	11y	114	121	29.96	30.09	+ .05	61.0	+ 3.8	79	11	70	47	7	52	25	55	52	76	1.52	— 0.8	6	2,823	n.	24	s.	29	11	11	8	4.3	
Tacoma	213	113	120	.....	.....	.....	.....	.....	...	...	...	...	...	...	...	...	...	...	.....	.....	...	.....	.....	.....	.....	...	...	...	...	...	
Astoria	.....	18	....	.....	.....	.....	60.5	+ 1.3	81	*	68	46	3	53	24	.....	.....	...	2.10	— 2.2	7	.....	n.	.....	.....	...	20	0	10	....	
Portland, Oreg	153	208	213	29.90	30.06	+ .03	64.1	+ 3.4	87	24	75	46	14	54	32	57	53	71	1.37	— 0.4	6	4,779	nw.	34	s.	30	19	4	7	3.8	
Roseburg	521	56	67	29.47	30.03	.00	64.1	+ 3.2	93	11	78	43	14	50	41	56	51	69	0.62	— 0.4	4	2,329	ne.	21	sw.	30	19	5	6	3.0	
Mid. Pac. C'st Reg.							66.0	+ 1.2										56	0.32	— 0.4								2.7	
Eureka	64	60	69	30.01	30.07	+ .08	54.8	— 0.6	74	15	59	46	2	50	22	52	51	88	0.88	— 0.4	3	2,895	nw.	29	nw.	13	5	9	16	6.7	
Mount Tamalpais	2,375	11	18	27.56	29.96	.....	73.2	.....	92	20	80	47	2	67	18	53	32	29	0.00	....	0	12,307	nw.	66	nw.	27	26	4	0	2.0	
Red Bluff	334	54	58	29.57	29.91	+ .01	78.0	+ 4.2	106	24	94	53	5	62	42	57	38	29	0.00	— 0.7	0	3,865	n.	36	n.	14	30	0	0	0.8	
Sacramento	71	106	117	29.84	29.91	— .01	72.9	+ 3.4	100	23	90	48	1	56	41	58	47	46	0.00	— 0.4	0	4,842	se.	24	sw.	2	30	0	0	1.2	
San Francisco	153	161	167	29.83	29.99	+ .06	58.2	— 2.2	73	13	65	48	23	51	23	54	52	89	0.00	— 0.3	0	9,066	sw.	40	w.	27	20	8	2	3.0	
Point Reyes Light	.....	12	16	.....	.....	.....	53.5	— 3.1	68	4	58	45	23	49	20	....	....	....	0.00	— 1.0	0	11,476	nw.	52	nw.	30	1	5	24	8.9	
S. Pac. Coast Reg.							69.7	+ 1.3										67	T.	— 0.1								2.0	
Fresno	332	67	70	29.55	29.89	+ .03	77.3	+ 2.8	102	10	95	50	5	60	41	58	43	34	0.00	— 0.2	0	3,892	nw.	28	nw.	2	29	1	0	0.8	
Los Angeles	330	74	82	29.54	29.89	+ .01	70.4	+ 1.9	95	17	83	51	5	58	37	61	37	75	T.	— 0.1	0	2,518	w.	12	w.	18	20	8	2	2.8	
San Diego	87	94	102	29.79	29.89	.00	65.5	— 1.5	92	22	71	55	4	60	33	62	60	86	0.00	— 0.1	0	3,807	nw.	23	nw.	22	28	0	2	1.7	
San Luis Obispo	201	10	46	29.75	29.97	+ .06	65.5	+ 2.1	99	13	81	44	7	50	47	55	51	72	0.00	— 0.1	0	3,189	n.	22	n.	3	22	7	1	2.8	
West Indies.																															
Basseterre	29	41	54	29.94	29.97	.....	81.2	.....	88	7	86	70	28	76	13	76	74	80	5.14	.....	13	7,634	e.	62	sw.	8	1	22	7	6.2	
Bridgetown	30	57	65	29.92	29.95	.....	80.9	.....	90	5	87	69	12	75	16	76	74	80	6.30	.....	17	5,071	e.	25	s.	8	2	15	13	6.6	
Cienfuegos	52	62	67	29.88	29.93	.....	80.8	.....	93	22	89	70	23	73	20	74	73	86	9.65	.....	22	3,752	ne.	22	nw.	7	13	13	4	3.8	
Havana	57	83	100	29.89	29.95	.....	81.0	.....	90	15	87	72	3	75	16	77	75	85	2.97	.....	12	4,757	e.	30	ne.	1	10	18	2	4.4	
Kingston	358	55	62	29.62	29.92	.....	80.7	.....	91	21	88	71	2	73	18	74	72	80	4.48	.....	16	4,213	ne.	27	se.	14	1	23	6	6.1	
Port of Spain	286	38	52	29.89	29.93	.....	80.9	.... ..	92	28	89	70	20	73	20	75	73	79	3.86	.....	13	3,035	e.	16	w.	21	13	13	4	4.7	
Puerto Principe	40	65	66	29.57	29.91	.....	81.7	.....	95	15	92	67	30	71	24	75	74	86	6.66	.....	12	3,824	ne.	31	e.	17	10	17	3	4.4	
Roseau	25	37	47	.....	.....	.....	.....	.....	...	...	...	...	...	...	...	...	...	...	.....	.....	...	.....	.....	.....	.....	...	...	...	...	...	
San Juan	82	48	90	29.88	29.96	.....	80.6	.....	91	11	86	71	30	75	14	76	74	81	13.66	+ 8.5	20	5,685	se.	31	nw.	9	13	11	6	4.6	
Santiago de Cuba	82	45	51	29.82	29.90	.....	82.3	.....	94	2	90	70	13	74	19	75	73	79	5.35	.....	18	3,052	ne.	18	ne.	30	3	27	0	5.2	
Santo Domingo	59	82	88	.....	.....	.....	.....	.....	...	...	...	...	...	...	...	...	...	...	.....	.....	...	.....	.....	.....	.....	...	...	...	...	...	
Willemstad	75	39	46	29.81	29.88	.. ....	83.8	.....	94	10	88	76	2	79	14	77	74	77	0.47	.....	3	8,418	e.	24	e.	13	10	17	3	4.8	

NOTE.—The data at stations having no departures are not used in computing the district averages. Letters of the alphabet denote number of days missing from the record. *Two or more dates. †Received too late to be considered in departures, etc.

TABLE II.—*Climatological record of voluntary and other cooperating observers, September, 1899.*

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Alabama.	°	°	°	*Ins.*	*Ins.*
Alco[g]	92	41	75.8	1.80	
Ashville	98	34	71.9	0.14	
Bermuda	93	41	72.6	1.04	
Birmingham	98	42	74.0	0.04	
Bridgeport	.....	.....	.....	0.87	
Citronelle	93	50	75.5	0.14	
Clanton	92	38	71.6	1.47	
Daphne	93[1]	49[c]	75.2[f]	2.80	
Decatur	98	37	71.6	0.11	
Demopolis	.....	.....	.....	0.21	
Eufaula[a]	97	39	74.2	1.16	
Evergreen	92	41	74.3	0.10	
Florence[a]	.....	.....	.....	0.93	
Florence[b]	99	37	72.4	0.96	
Fort Deposit	94	44	74.0	1.08	
Gadsden	99	34	72.2	0.08	
Goodwater	98	37	73.1	0.26	
Greensboro	97	45	74.2	0.50	
Healing Springs	98	36	73.1	0.32	
Highland Home	91[c]	49[c]	74.2[c]	0.62	
Jasper	.....	31	.....	0.16	
Livingston[a]	95	40	72.8	0.36	
Lock No. 4	94	38	71.3	0.06	
Madison Station	97	31	72.0	0.08	
Maplegrove	97	35	69.7	0.71	
Marion	102	43	72.0	0.59	
Mount Willing	97	42	74.9	0.43	
Newbern	96	44	74.0	0.78	
Newburg	99	30	69.6	1.00	
Newton	95	41	72.4	1.24	
Oneonta	94	34	69.6	2.02	
Opelika	97	42	74.5	0.31	
Oxanna	94	37	70.4	0.05	
Pineapple	100	42	74.6	1.20	
Pushmataha	97	39	74.0	0.16	
Riverton	104	32	70.5	0.23	
Scottsboro	94	34	68.8	T.	
Selma	99	42	77.0	0.38	
Talladega	96	36	70.8	0.00	
Tallassee	.....	.....	.....	0.24	
Thomasville	97	42	74.0	T.	
Tuscaloosa	99	40	72.2	T.	
Tuscumbia	99	39	72.0	0.85	
Union Springs	93	45	74.0	0.58	
Uniontown	98	47	76.2	0.04	
Valleyhead	97	38	69.1	1.78	
Warrior	.....	.....	.....	0.00	
Wetumpka	97	40	74.8	0.22	
Wilson[*1]	97	48	75.6	0.65	
Alaska.					
Sitka	68	40	51.0	8.52	
Arizona.					
Allaire Ranch	.....	.....	.....	1.84	
Arizona Canal Co. Dam	112	64	84.9	0.98	
Aztec[*1]	114	74	91.3	T.	
Benson[*1]	99	45	83.1	0.75	
Bisbee	96	54	73.8	2.85	
Blaisdell[*1]	114	78	94.2	0.00	
Buckeye	110	56	83.7	0.40	
Camp Creek	104	63	81.4	1.55	
Casagrande[*1]	105	70	88.5	0.00	
Champie Camp	112	63	86.6	0.25	
Congress	104	66	85.2	0.10	
Dragoon	.....	.....	.....	2.88	
Dragoon Summit[*1]	95	60	71.2	1.04	
Dudleyville	105	49	77.6	1.39	
Fort Apache	96	43	69.8	1.52	
Fort Defiance	.....	36	.....	0.78	
Fort Grant	98	56	75.8	0.69	
Fort Huachuca	99	56	76.0	0.51	
Fort Mohave	116	61	88.8	T.	
Gilabend[*1]	110	68	89.2	0.80	
Holbrook	100	38	70.1	0.05	
Hot Springs	109[c]	61	86.0[d]	0.08	
Ingleside	109	59	83.9	0.54	
Jerome	98	55	78.4	0.10	
Lochiel[*1]	92	57	70.7	0.50	
Maricopa[*1]	107	70	88.1	0.36	
Mesa	111	52	82.6	0.76	
Mount Huachuca	92	45	72.3	1.46	
Music Mountain	108	52	80.6	0.05	
Natural Bridge	.....	.....	.....	1.79	
Nogales	103	50	74.8	1.71	
Oracle	97	55	76.2	0.48	
Oro	.....	.....	.....	0.72	
Pantano[*1]	100	65	77.6	1.08	
Phenix	113	56	84.0	0.89	
Pima	.....	.....	.....	1.64	
Pinal Ranch	.....	.....	.....	5.03	
Prescott	97	38	69.0	0.00	
Sentinel[*1]	115	75	92.9	T.	
Signal	115	54	85.0	T.	
Silverking	.....	.....	.....	3.79	
Snowflake	92[c]	32	65.4[c]	0.26	
Strawberry	89	40	64.8	2.05	
Supai	111	58	83.8	0.20	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
***Arizona*—Cont'd.**	°	°	°	*Ins.*	*Ins.*
Texas Hill[*1]	118	73	93.6	0.00	
Tombstone	98	59	76.8	1.07	
Tonto	.....	51	.....	0.89	
Tuba[f]	100	46	76.5	0.00	
Tucson	107	52	82.4	0.03	
Walnut Grove	.....	.....	.....	0.00	
Whitehills	106	65	82.0	0.25	
Willcox	.....	.....	.....	1.26	
Winslow	95	42	68.8	0.10	
Yarnell	.....	.....	.....	0.80	
Arkansas.					
Amity	100	37	71.5	1.01	
Arkansas City	.....	.....	.....	0.65	
Beebranch	103[c]	35[c]	72.6[c]	1.00	
Blanchard Springs	100	36	71.3	0.77	
Brinkley	101	36	71.8	0.52	
Camden[a]	.....	.....	.....	2.24	
Camden[b]	101	40	72.6	2.05	
Canton	100	33	69.0	1.96	
Conway	109	36	74.2	1.43	
Corning	102	28	68.6	0.82	
Dallas	102	41	73.8	2.52	
Dardanelle	.....	.....	.....	T.	
Elon	107	36	72.7	0.46	
Fayetteville	99	32	69.7	0.78	
Forrest	98	44	72.8	0.02	
Fulton	.....	.....	.....	0.95	
Hardy	99	37	69.8	2.42	
Helena[a]	.....	.....	.....	0.49	
Helena[b]	103	42	74.3	0.48	
Hot Springs[a]	103	40	73.3	3.00	
Hot Springs[b]	.....	.....	.....	4.12	
Jonesboro	.....	38	.....	0.37	
Keesees Ferry	104	32	70.6	0.25	
Lacrosse	89	36	66.2[c]	2.94	
Lonoke	100	37	70.9	1.20	
Luna Landing[*5]	96	42	72.6	T.	
Malvern	104	39	72.2	1.69	
Marianna	96	38	70.7	0.37	
Marvell	101	40	72.6	0.82	
Moore	.....	.....	.....	1.40	
Mossville	97	35	69.9	1.87	
Mount Nebo	95	.....	.....	1.64	
Nashville	104	39	74.9	0.15	
New Gascony	100	39	72.0	2.08	
Newport[a]	.....	.....	.....	1.50	
Newport[b]	100	37	71.5	1.35	
Newport[c]	98	33	70.8	1.41	
Oregon	102	34	69.8	1.25	
Osceola	102	36	74.0	0.59	
Ozark	105	42	77.0	0.49	
Pinebluff	106	40	73.8	2.33	
Pocahontas	98	36	69.6	1.75	
Pond	99	30	66.9	1.75	
Powell	105	32	70.6	0.35	
Prescott	104	43	75.2	0.83	
Rison	.....	39	.....	2.58	
Russellville	102	36	72.2	1.62	
Silversprings	100	33	70.5	0.85	
Spielerville	105	36	73.0	0.81	
Stamps	100	44	71.2	1.12	
Stuttgart	103	35	72.1	1.02	
Texarkana	105	42	75.1	0.07	
Warren	105	40	73.6	2.50	
Washington	99	45	73.2	0.66	
Wiggs[*1]	102	43	74.5	0.38	
Winslow	94	40	68.4	1.53	
Witts Springs	101[c]	38[c]	69.6[c]	0.36	
California.					
Anada	99	36	64.7	0.00	
Angiola	106	43	74.8	0.00	
Arlington Heights	107	52	77.5	0.00	
Bakersfield	107	45	75.8	T.	
Bear Valley	.....	.....	.....	0.00	
Berkeley	77	50	60.9	0.00	
Bishop	97	37	67.7	0.00	
Blue Lake	104	40	71.4	0.00	
Boca[*1]	86	26	51.5	0.00	
Bodie	80	18	50.6	0.00	
Bowman	.....	.....	.....	0.00	
Cahto	.....	.....	.....	1.00	
Caliente[*1]	100	58	80.4	0.00	
Campbell	91	37	63.2	0.00	
Cedarville	90	37	62.9	0.00	
Centerville[*1]	100	54	67.4	0.00	
Chico[*1]	105	58	76.8	0.00	
Chino	.....	.....	.....	0.00	
Cisco[*1]	80	40	56.1	0.00	
Claremont	99	46	73.8	0.07	
Corning[*1]	108	60	75.9	0.00	
Coronado	77	60	66.1	.....	
Craftonville	103	53	78.8	0.12	
Crescent City	83	40	56.1	2.61	
Cuyamaca	95	20	64.6	0.00	
Delano[*1]	98	62	79.2	0.00	
Delta[*1]	104	50	73.2	0.00	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
***California*—Cont'd.**	°	°	°	*Ins.*	*Ins.*
Dewey	106	52	77.4	0.00	
Drytown	103	44	75.6	0.00	
Dunnigan[*1]	102	62	78.6	0.00	
Durham[*1]	102	50	74.5	0.00	
Edmanton[*1]	91	38	63.2	0.00	
Elcajon	104	42	72.1	0.00	
Elmwood	104	41	73.3	0.00	
Elsinore	114	45	77.6	T.	
Escondido	97	37	68.6	0.00	
Fallbrook[*1]	104	55	67.8	0.00	
Folsom City[*1]	98	56	73.6	0.00	
Fordyce Dam	.....	.....	.....	0.00	
Fort Ross	77	43	56.3	0.00	
Georgetown	95	48	72.9	0.00	
Gilroy (near)	102	39	67.0	0.00	
Glendora	.....	.....	.....	0.07	
Goshen[*1]	102	49	73.4	0.00	
Grand Island[*5]	104	49	77.1	0.00	
Grass Valley	.....	.....	.....	0.00	
Greenville	97	27	60.7	0.00	
Hanford	102	46	74.0	0.00	
Hill Ranch	104	44	74.6	T.	
Hollister	101	38	66.6	0.00	
Indio[*1]	110	70	90.2	0.10	
Iowa Hill[*1]	95	54	72.7	0.00	
Irvine	102	58	77.2	0.12	
Jackson	90	42	70.7	0.00	
Jolon	.....	.....	.....	0.00	
Keene[*1]	96	50	69.1	0.00	
Kennedy Gold Mine	94	43	72.3	0.00	
Kernville	.....	.....	.....	0.00	
King City[*1]	100	46	62.4	0.00	
Kingsburg[*5]	100	60	79.7	0.00	
Kono Tayee	92	50	72.4	0.00	
Lagrange[*5]	105	55	79.9	0.00	
Lakeside	.....	.....	.....	0.00	
Lamesa	.....	.....	.....	0.00	
Lankershim	105	48	75.8	0.00	
Laporte[*1]	83	41	58.5	0.00	
Legrand	104	40	74.2	0.00	
Lemoncove	106	50	79.8	0.00	
Lemoore[a*1]	101	53	75.3	0.00	
Lick Observatory	91	43	69.8	T.	
Lodi	99	49	72.6	0.00	
Los Alamos	.....	.....	.....	0.00	
Los Gatos[b]	94	45	65.8	0.00	
Malakoff Mine	92	44	68.3	0.00	
Mammoth[*1]	112	80	91.0	0.00	
Manzana	100	57	80.2	0.00	
Merced[a*1]	101	57	71.2	0.00	
Merced[b]	105	49	75.6	0.00	
Mills College	.....	.....	.....	0.00	
Milo	.....	.....	.....	0.00	
Milton (near)[*1]	98	53	75.7	0.00	
Modesto[*1]	102	56	73.8	0.00	
Mohave[*1]	100	60	79.4	0.00	
Mokelumne Hill[*3]	.....	50	72.4	T.	
Monterio	96	54	77.1	0.00	
Monterey[*1]	80	54	62.9	0.00	
Moreno	103	40	74.4	T.	
Mountainview	.....	.....	.....	0.00	
Napa[b]	98	42	66.7	0.00	
Needles	109	66	87.2	0.28	
Nevada City	89	39	64.8	0.00	
Newhall[*1]	108	58	78.9	0.00	
North Ontario	98	50	75.5	0.05	
North San Juan[*1]	97	48	68.8	0.00	
Oakland[a]	78	48	60.6	0.00	
Ogilby[*1]	122	80	98.0	0.00	
Oleta[*1]	94	51	68.6	T.	
Orland[*1]	106	60	78.1	0.00	
Palermo	104	45	74.4	0.00	
Paso Robles[b]	97	44	69.4	T.	
Peachland[*5]	85	45	64.0	0.00	
Pilot Creek	.....	.....	.....	0.00	
Pine Crest	99	52	74.0	T.	
Placerville	92	40	66.6	0.00	
Point Lobos	66	48	55.2	0.00	
Pomona (near)	106	49	75.8	0.00	
Poway[*2]	95	56	64.4	0.00	
Quincy	89	32	58.4	0.00	
Ranch House	94	56	73.6	0.08	
Redding	103	53	77.8	0.00	
Redlands	106	52	79.0	0.05	
Reedly	104	.....	.....	0.00	
Represa	94	52	72.6	0.00	
Riovista	100	52[d]	73.6	0.00	
Romie	102	38	66.1	0.00	
Rosewood	104	44	72.6	0.00	
Sacramento[a]	92	46	69.0	0.00	
Salinas[*1]	81	45	58.6	0.00	
Salton[*5]	119	75	99.9	0.00	
San Bernardino	110	43	75.8	0.01	
San Jacinto	109	46	78.4	0.00	
San Leandro[*1]	86	54	63.6	0.00	
San Mateo[*1]	81	52	64.9	0.00	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
California—Cont'd.	°	°	°	*Ins.*	*Ins.*
San Miguel *1	102	52	79.0	0.00	
San Miguel Island	70	40	54.8	0.00	
Santa Barbara *a*	84	52	66.0	0.00	
Santa Clara *a*	94	40	58.1	0.00	
Santa Cruz *b*	90	40	61.3	0.00	
Santa Maria	83	45	64.4	0.00	
Santa Monica *1	75	57	66.5	0.00	
Santa Paula	90	48	67.8	0.00	
Santa Rosa *1	87	47	65.0	0.00	
Shasta	108	50	79.7	0.00	
Sierra Madre	97	52	74.2	0.01	
Snedden	.....	.....	.....	0.00	
Sonoma	.....	.....	.....	0.00	
Stanford University	93	43	64.2	0.00	
Stockton *a*	95	49	71.2	0.00	
Summerdale	88	41	66.4	0.00	
Susanville	86	36	61.1	0.00	
Tehama *1	105	57	74.8	0.00	
Tejon Ranch	101	56	81.5	T.	
Templeton *1	105	45	65.4	0.00	
Thermalito	106	51	77.9	0.00	
Truckee *1	78	34	49.5	0.00	
Tulare *c*	108	46	75.6	T.	
Ukiah	108	38	69.9	0.00	
Upperlake	105	40	71.8	0.00	
Upper Mattole *1	105	50	65.6	1.00	
Vacaville *a* *1	106	54	75.8	0.00	
Ventura	76	43	61.6	T.	
Visalia *a* *1	94	56	67.6	0.00	
Visalia *b*	105	45	74.8	0.00	
Volcano *1	119	80	93.7	0.13	
Walnut Creek	99	54	73.4	0.00	
West Palmdale	.....	.....	.....	0.00	
Westpoint	.....	.....	.....	0.00	
West Saticoy	.....	.....	.....	0.00	
Wheatland	100	44	71.8	0.00	
Williams *1	102	55	78.3	0.00	
Wilmington *1	85	60	68.0	0.35	
Wire Bridge *b	99	49	73.7	0.00	
Yreka	93	34	65.0	0.07	
Yuba City *b	102	51	75.4	0.00	
Colorado.					
Antlers	92	40	64.6	1.07	
Arkins	.....	.....	.....	0.19	
Aspen	.....	.....	.....	1.15	0.5
Boulder	93	40	66.0	0.15	
Boxelder	.....	.....	.....	0.13	
Breckenridge	73	21	45.4	0.29	0.1
Buenavista	.....	.....	.....	0.59	
Canyon	100	35	68.5	0.70	
Castlerock	95	27	59.7	T.	
Cedaredge	89	37	63.1	0.28	
Cheyenne Wells	102	32	66.3	0.78	
Clearview *1	80	28	46.8	2.62	
Colorado Springs	93	30	62.9	0.08	
Cripplecreek	.....	33	.....	1.42	T.
Crook	102	28	66.8	0.04	
Delta	101	33	65.2	0.40	
Dumont	.....	.....	.....	0.60	
Durango	88	36 f	61.8 e	0.60	
Fairview	88	25	56.0	0.52	
Fort Collins	95	29	61.4	0.21	
Fox	.....	.....	.....	0.22	
Garnett	87	28	56.0	1.91	
Georgetown	82	31	56.2	.....	
Gilman	.....	.....	.....	0.36	0.5
Gleneyrie	.....	.....	.....	0.12	
Glenwood	.....	.....	.....	0.23	
Greeley	98	30	62.9	0.30	
Gunnison	80	23	51.4	0.50	
Gypsum	.....	.....	.....	0.87	
Hamps	92	29	61.8	0.19	
Hoehne	96	33	64.4	1.14	
Holly	.....	.....	.....	1.13	
Holyoke (near)	105 e	26 e	66.6 e	0.00	
Hugo	.....	.....	.....	T.	
Husted	97	34 e	63.4 e	0.07	
Lake Moraine	75	25	48.8	0.79	1.5
Lamar	106	38	70.0	1.22	
Laporte	.....	.....	.....	0.18	
Las Animas	103	42	69.0	0.85	
Leadville (near) *1	73	34	49.5	0.53	
Leroy	97	28	64.6	0.88	
Longs Peak	82	30	51.4	0.11	
Mancos	92	32	61.6	0.33	
Marshall Pass	.....	.....	.....	0.68	5.5
Meeker	88	27	56.0	0.35	
Minneapolis	102	36	68.6	2.65	
Montrose	.....	.....	.....	0.35	
Moraine	83	22	54.6	0.15	
Pagoda	92	25	57.4	0.50	
Palmer	.....	.....	.....	0.02	
Parachute	96	39	68.0	0.55	
Perrypark	.....	.....	.....	0.00	
Rockyford	99	35	65.8	1.43	
Ruby	.....	.....	.....	0.85	0.1

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Colorado—Cont'd.	°	°	°	*Ins.*	*Ins.*
Saguache	83	36	58.1	1.19	
Salida	92	31	59.4	1.15	
San Luis	89	32	57.8	2.08	
Santa Clara *1	86	17	56.3	3.10	
Sapinero	.....	.....	.....	0.55	
Sargents	.....	.....	.....	1.53	T.
Seibert	.....	.....	.....	0.36	
Smoky Hill Mine	89	22	56.2	0.60	
Springfield	.....	.....	.....	2.35	
Strickler Tunnel	.....	.....	.....	1.44	0.8
Tennessee Pass	.....	.....	.....	0.23	0.5
Trinidad	.....	.....	.....	0.98	
Troutvale	82	19	48.0	1.66	
T. S. Ranch	91	43	67.4	0.67	
Twinlakes	.....	.....	.....	0.56	
Vilas	.....	.....	.....	2.19	
Wagon Wheel	83	19	50.2	1.85	
Wallet	.....	.....	.....	1.35	
Westcliffe	86	25	56.0	2.02	
Wray	100	30	66.0	0.08	
Yuma	.....	.....	.....	0.17	
Connecticut.					
Bridgeport	86	36	63.0	4.55	
Canton	82	32	58.4	4.83	
Colchester	81	35	60.9	3.47	
Falls Village	.....	.....	.....	4.82	
Greenfield Hill	.....	.....	.....	5.07	
Hartford *a*	.....	.....	.....	4.03	
Hartford *b*	81 c	41 f	61.6 e	4.15	
Hawleyville	85	34	61.4	5.67	
Lake Konomoc	.....	.....	.....	6.92	
New London	82	42	61.8	4.32	
North Franklin	.....	.....	.....	5.25	
North Grosvenor Dale	81 b	28 b	57.6 b	4.40	
Norwalk	84	35	60.3	4.80	
Southington	81	35	60.9	4.13	
Storrs	80	35	59.2	3.31	
Voluntown	82	32	59.8	8.41	
Wallingford	.....	.....	.....	3.79	
Waterbury	88	34	62.6	5.30	
West Cornwall	79	38	58.6	4.21	
West Simsbury	.....	.....	.....	4.29	
Winsted *1	82	40	56.4	.....	
Delaware.					
Milford	91	42	68.8	2.36	
Millsboro	92	39	66.3	1.57	
Newark	90	39	63.6	5.27	
Seaford	92	41	66.9	2.05	
District of Columbia.					
Distributing Reservoir *b	90	47	67.2	5.39	
Receiving Reservoir *b	90	46	66.8	6.78	
West Washington	94	39	66.3	6.30	
Florida.					
Archer	95	.....	.....	3.58	
Bartow	92	65	79.3	10.58	
Brooksville	91	58	78.0	6.17	
Carrabelle	.....	.....	.....	1.80	
Clermont	95	63	79.8	.....	
Dalkeith	95	48	76.8	1.28	
De Funiak Springs	97	45	76.4	0.14	
Estero *1	91	74	80.4	.....	
Eustis	93	58	79.2	6.20	
Federal Point	91	58	77.2	4.62	
Fort Meade	94	64	79.8	10.45	
Gainesville	93	55	77.4	3.98	
Homeland	89	63	76.4	.....	
Huntington	93	57	77.0	4.84	
Inverness	92	59	77.9	2.95	
Jasper	93	52	76.8	0.65	
Kissimmee	95	.....	.....	7.03	
Lake Butler	97	55	78.6	5.93	
Lake City	97	51	78.2	2.95	
Lemon City	90	70	80.7	9.66	
Maccienny	97	47	77.5	2.94	
Manatee	90	64	78.4	5.17	
Merritt Island	92	69	81.2	6.00	
Myers	89	69	79.6	2.31	
Ocala	97	53	78.6	6.16	
Orange City	93	63	79.6	5.35	
Orlando	92	64	79.2	7.77	
Plant City	95	62	79.5	6.19	
St. Andrews	93	51	77.0	4.87	
St. Francis	93	61	77.6	5.28	
St. Francis Barracks	90	51	77.2	4.66	
Sebastian	91	71	80.4	6.48	
Stephensville *1	93	59	76.6	2.25	
Switzerland *1	91	58	77.2	4.01	
Tallahassee	90	52	75.4	2.45	
Tarpon Springs	91	60	78.4	5.52	
Wausau	95	40	74.4	1.12	
Georgia.					
Adairsville	93	40	69.3	2.23	
Alapaha	97	48	76.0	0.83	
Albany	97	46	77.3	0.91	
Allentown	101	35	77.0	0.40	
Americus	96	43	74.1	0.59	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Georgia—Cont'd.	°	°	°	*Ins.*	*Ins.*
Athens *b*	94	42	71.2	1.45	
Bainbridge	92	45	75.0	1.36	
Bellville	99	46	76.8	0.80	
Blakely	93	46	75.9	0.76	
Camak	94	45	73.2	2.32	
Carlton	.....	.....	.....	1.49	
Clayton	91	37	67.6	2.28	
Columbus e	99	50	76.8	0.32	
Covington	102	39	72.9	1.54	
Crescent	.....	.....	.....	6.16	
Dahlonega	92	34	66.8	0.76	
Diamond	89	.....	.....	2.25	
Dublin	.....	.....	.....	1.14	
Eastman	98	47	76.7	0.37	
Elberton	96	46	72.8	0.99	
Fitzgerald	94	46	74.1	0.62	
Fleming	96	45	75.3	5.80	
Fort Gaines	94	47	74.2	0.54	
Franklin	96	43	74.4	0.16	
Gainesville	92	38	69.2	0.40	
Gillsville	97	37	71.6	0.53	
Greenbush	95 e	36 e	68.4 e	1.76	
Griffin	96	39	71.7	0.12	
Harrison	.....	.....	.....	0.48	
Hawkinsville	95	47	73.2	0.33	
Hephzibah	92	56	76.5	2.92	
Jesup	102	42	76.1	1.24	
Louisville	98	46	75.6	1.91	
Marshallville	95	45	75.0	0.72	
Mauzy	100	45	75.6	7.62	
Millen	99	43	75.4	1.16	
Morgan	99	41	75.4	0.35	
Newnan	94	42	71.8	0.76	
Oakdale	.....	.....	.....	1.06	
Pelham	95	.....	.....	1.54	
Point Peter	92	38	69.0	1.14	
Poulan	98	40	74.4	0.83	
Putnam	95	45	73.4	0.46	
Quitman	94	44	75.5	0.79	
Ramsey	97	36	70.1	2.17	
Rome	99	40	71.3	2.74	
Talbotton	100	42	74.6	1.76	
Tallapoosa	93	36	67.8	0.20	
Thomasville	96	46	77.6	0.71	
Toccoa	93	41	70.4	0.52	
Union Point	93	45	71.8	1.25	
Washington	94	47	73.0	1.80	
Way Cross	97	52	76.6	2.47	
Waynesboro	94	42	71.6	0.57	
Westpoint	96	42	73.2	0.29	
Idaho.					
American Falls	100	32	65.0	0.00	
Atlanta	84	27	54.0	0.62	
Blackfoot	88	29	57.4	T.	
Challis	89	33	60.6	0.40	
Chesterfield	86	14	55.0	0.00	
Downey	91	21	57.1	0.00	
Fort Sherman	90	36	59.2	1.85	
Gray	86	24	55.0	0.00	
Hagerman	.....	.....	.....	0.09	
Idaho City	87 e	28 e	57.8 e	T.	
Kootenai	79	26	52.6	0.24	
Lakeview	79	39	58.8	2.48	
Lewiston	91	40	63.8	0.71	
Lost River	86	27	58.2	0.17	
Moscow	84	40	59.8	1.38	
Murray	82	33	55.3	1.62	
Oakley	95	35	63.8	0.00	
Ola	93	36	63.4	0.46	
Paris	86	28	57.8	0.05	
Payette	100	36	66.4	0.17	
Pollock	91	37	62.4	0.71	
Priest River	83	39	60.0	1.35	
St. Maries	87	35	59.6	1.45	
Salubria	96	32	61.8	0.12	
Soldier	89	20	55.2	0.04	
Swan Valley	88	18	53.4	T.	
Weston	85	33	59.6	0.05	
Illinois.					
Alexander	106	23	66.8	4.29	
Ashton	100	20	62.3	1.51	
Astoria	96	24	63.0	4.26	
Aurora *a*	101	24	63.4	2.23	
Aurora *b*	99	24	62.6	2.35	
Bloomington	103	22	65.6	1.98	
Bushnell	103	26	65.5	3.83	
Cambridge	97	25	63.0	2.22	
Carlinville	103	25	67.0	2.29	
Carlyle	.....	.....	.....	0.46	
Charleston	100	25	66.6	0.89	
Chemung	96	19	60.0	2.29	
Chester	.....	.....	.....	0.80	
Cisne	101	25	68.2	0.77	
Coatsburg	99	29	65.0	2.53	
Cobden	105	32	70.4	2.44	
Danville	.....	22	.....	2.54	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Illinois—Cont'd.	°	°	°	*Ins.*	*Ins.*
Decatur	103	20	66.4	1.50	
Dixon	100	23	63.8	1.48	
Dwight	97	22	61.9	2.57	
Effingham	102	24	67.3	0.58	
Elgin	99	25	62.8	2.28	
Equality	102	27	69.4	3.14	
Flora	101	25	67.6	0.60	
Fort Sheridan	96	32	61.8	2.76	
Friendgrove *1	100	34	69.7	1.01	
Galva	101	23	63.8	2.46	
Glenwood *1	100[b]	30[b]	61.8[b]	3.41	
Grafton	.....	.....	.....	1.46	
Grayville	101	33	70.5	1.64	
Greenville	102	30	67.2	0.84	
Griggsville	103	29	66.4	3.79	
Halfway	102	30	70.4	3.08	
Halliday	104	30	69.9	1.07	
Havana	97	32	66.2	4.18	
Henry	104	30	64.3	3.12	
Hillsboro	102	26	67.1	1.59	
Joliet	100	28	63.1	2.44	
Kankakee	102	35	66.4	2.83	
Knoxville	100	19	62.8	2.95	
Lagrange	98	27	61.6	1.73	
Laharpe	101	23	63.9	2.82	
Lanark	97	14	61.2	1.33	
Loami	.....	.....	.....	2.64	
McLeansboro	102	29	69.2	2.02	
Martinsville	99	25	66.8	0.69	
Martinton	104	20	65.0	2.30	
Mascoutah	104	24	67.4	0.65	
Mattoon	98	28	67.1	1.02	
Minonk	104	22	63.4	4.20	
Monmouth	102	18	64.0	2.26	
Monticello *5	101	25	66.2	1.87	
Morrisonville	99	24	65.0	0.98	
Mount Carmel	.....	.....	.....	2.08	
Mount Pulaski	102	26	66.4	2.11	
Mount Vernon	104	23	67.5	0.99	
New Burnside	104	25	70.4	1.53	
Olney	101	27	68.4	0.93	
Ottawa	102	26	64.8	2.15	
Palestine	101	28	65.8	1.47	
Pana	103	26	65.8	1.35	
Paris	103	24	67.2	0.92	
Peoria *a*	.....	.....	.....	5.05	
Peoria *b*	104	26	65.6	5.24	
Philo	101	17	64.4	0.50	
Plumhill	104	25	68.8	0.55	
Rantoul	103	24	65.0	2.59	
Raum	100	32	70.2	2.33	
Riley	98	24	62.0	1.59	
Robinson	103	25	68.3	0.37	
Rockford	98	22	63.0	1.61	
Roundgrove	103	19	63.1	0.96	
St. Charles *1	92[d]	25	59.5[d]	3.10	
St. John	104	27	70.4	0.84	
Savanna	98	14	62.2	1.11	
Scales Mound	94	15	60.4	1.14	
Strawn	101	25	64.8	3.79	
Streator	103	20	62.0	2.73	
Sullivan	102	24	66.6	1.09	
Sycamore	99	22	61.4	1.73	
Tilden	105	22	68.7	0.93	
Tiskilwa	100	25	64.0	2.55	
Tuscola	103	21	65.9	0.72	
Walnut	101	22	64.5	1.91	
Wheaton *2	.....	30	60.2	2.21	
Winchester	99	23	64.6	4.67	
Winnebago	98	18	62.0	1.68	
Indiana.					
Anderson	98	26	65.1	3.08	
Angola	92	28	60.8	3.21	
Auburn	94	29	61.5	2.17	
Bedford	105	28	68.2	1.19	
Bloomington	100	28	68.1	0.48	
Bluffton	100	31	64.8	1.59	
Bright	104	29	65.4	0.48	
Butlerville	103	25	67.4	1.85	
Cambridge City	99	25	63.6	1.28	
Columbia City *1	90	33	60.8	4.23	T.
Columbus	102	27	66.0	1.41	
Connersville	99	27	65.1	1.39	
Delphi	100	25	64.0	2.24	
Edwardsville *1	94	30	68.8	0.78	
Fairmount	102	26	64.6	1.98	
Farmland	97	29	64.0[1]	1.02	
Fort Wayne	97	31	63.1	3.49	
Franklin *1	99	33	64.9	1.67	
Greencastle	99	29	66.0	1.86	
Greensburg	100	26	68.0	0.09	
Hammond	100	33	66.1	2.99	
Hector	99	30	66.6	1.67	
Huntington	97	42	65.0	2.65	
Jeffersonville	98	33	69.4	0.87	
Knightstown	102[d]	25[d]	65.4[d]	1.51	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Indiana—Cont'd.	°	°	°	*Ins.*	*Ins.*
Kokomo	96	30	63.9	3.38	
Lafayette	101	24	65.0	1.68	
Laporte	103	32	64.5	2.76	0.5
Logansport	97	30	63.4	0.97	
Madison	101	30	69.2	0.69	
Marengo	99	26	67.0	0.88	
Marion	101	29	65.2	3.71	
Markle	100	32	63.9	1.60	
Mauzy	101	25	66.0	1.17	
Michigan City *10	90	32	62.6	.....	
Mount Vernon	102	29	69.3	1.37	
Northfield	.....	22	.....	2.55	
Paoli	98	26	67.2	1.58	
Peru	100	31	63.4	1.55	
Prairie Creek	105	21	68.8	0.53	
Princeton	105	27	68.6	2.15	
Richmond	98	28	64.8	1.49	
Rockport	96	33	70.8	0.78	
Rockville	103	26	66.1	1.43	
Salem	98	25	66.0	0.92	
Scottsburg	99	30	67.6	0.86	
Seymour	101	30	67.6	1.55	
Shelbyville	98	31	66.5	1.32	
South Bend	96	31	63.0	4.05	T.
Syracuse	91	32	62.0	2.71	T.
Terre Haute	103	30	69.0	0.73	
Topeka	92	31	61.3	2.24	
Valparaiso	100	34	65.1	1.50	
Vevay	99	32	68.9	3.05	
Vincennes	106	30	69.9	0.81	
Washington	100	35	70.8	1.54	
Winamac	97	24	65.9	2.46	
Worthington	106	22	67.8	0.71	
Indian Territory.					
Hartshorne	105	.....	.....	0.50	
Healdton	105	38	74.6	1.20	
Lehigh	104	40	75.3	1.65	
Muscogee	104	38	73.3	0.05	
Ryan	102	45	76.4	2.74	
Sapulpa	105	35	73.9	1.10	
South McAlester	.....	.....	.....	0.66	
Tahlequah	99°	33	69.2	0.80	
Tulsa	.....	.....	.....	0.47	
Wagoner	.....	.....	.....	1.47	
Webbers Falls	.....	.....	.....	0.50	
Iowa.					
Afton	98	24	63.0	0.50	
Albia	97	22	62.8	1.09	
Algona *1	94	24	60.8	0.92	
Alta *a*	98	20	61.8	0.17	
Amana	97	18	62.9	0.62	
Ames *b*	98	22	62.8	0.89	
Ames (near)	.....	.....	.....	0.35	
Atlantic	99	17	62.0	0.56	
Audubon	95	24	62.6	0.60	
Bancroft	96	19	60.4	1.09	T.
Batavia	.....	.....	.....	1.01	
Baxter	101	22	63.1	0.36	
Bedford	102	22	64.6	0.76	
Belknap	100	27	65.0	1.59	
Bellplaine	96	23	62.6	0.50	
Blockton	97	28	63.8	T.	
Bonaparte	103	26	65.4	1.11	
Britt	97	20	59.8	1.94	
Burlington	103	23	65.6	2.37	
Bussey	.....	.....	.....	0.83	
Carroll	97	19	61.8	0.87	
Carson	.....	.....	.....	0.63	
Cedarfalls	99	19	62.8	0.58	
Cedar Rapids	102	22	66.0	0.37	
Centerville	100	25	65.4	1.55	
Chariton	98	24	63.8	0.81	
Charles City	90	19	60.8	1.45	
Chillicothe	.....	.....	.....	1.40	
Clarinda	101	26	65.4	0.87	
Clinton	98	19	62.3	0.76	
College Springs	97°	24	66.1°	0.78	
Coon Rapids	96	23	63.1	0.72	
Corning	96	24	63.4	0.59	
Council Bluffs	101	26	65.8	0.77	
Cresco	90	21	58.2	1.54	
Cumberland	.....	.....	.....	1.17	
Danville	.....	.....	.....	1.46	
Decorah	90	18	59.4	1.80	
Delaware	95	16	61.2	1.11	
Denison	98	18	62.6	0.45	
Desoto	100	22	63.6	0.71	
Diagonal	96	24	63.0	0.50	
Dows	98	19	59.6	2.14	
Eldon	104	22	65.5	1.25	
Elkader	100	17	59.8	0.91	
Emerson	.....	.....	.....	0.05	
Emmetsburg	.....	.....	.....	0.67	
Estherville	97	18	58.9	T.	
Fairfield	99	27	64.1	1.69	
Fayette	95	15	60.0	0.70	T.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Iowa—Cont'd.	°	°	°	*Ins.*	
Fonda	.....	.....	.....	0.00	
Forest City	97	22	61.4	1.67	
Fort Madison	.....	.....	.....	3.72	
Galva	98	20	66.7	0.10	
Gilman	.....	.....	.....	0.28	
Gladbrook	.....	.....	.....	0.55	
Glenwood	100	22	66.0	0.62	
Grand Meadow *1	97	26	59.0	1.21	
Greene	95	19	61.6	1.28	
Greenfield	97	22	63.2	0.51	
Grinnell	96	25	62.8	0.21	
Grinnell (near)	98	24	62.7	0.25	
Griswold	.....	.....	.....	0.52	
Grundy Center	99	20	60.2	0.78	
Guthrie Center	98[1]	19[4]	57.8[1]	0.57	
Hampton	100	24	62.1	1.74	
Harlan	96	20	63.0	0.84	
Hawkeye	.....	.....	.....	1.27	
Hopeville	97	27	64.4	0.59	
Humboldt	97	21	62.0	1.22	
Independence	96	18	60.8	0.64	
Indianola	99	23	64.3	2.12	
Iowa City	101	20	62.1	0.98	
Iowa Falls	98	19	60.6	2.25	
Keosauqua	100	24	65.8	1.35	
Knoxville	98	25	64.5	0.58	
Lacona	.....	.....	.....	0.70	
Lamoni	96	24	63.4	0.73	
Lansing	93	22	61.9	1.57	
Larrabee	97	16	61.4	0.30	
Leclaire	.....	.....	.....	0.89	
Lemars	96	25	62.5	0.85	
Lenox	95	25	63.6	0.94	
Logan	97	19	64.0	0.42	
Maple Valley	.....	.....	.....	0.22	
Maquoketa	96	17	61.6	1.10	
Marshalltown	100	22	63.8	0.78	
Mason City	97°	15°	60.2°	1.40	
Melrose	.....	.....	.....	1.37	
Monticello	98	16	59.1	0.56	
Mooar	100	25	65.0	3.04	
Mountayr	98	24	64.8	1.06	
Mount Pleasant	101	25	65.0	1.55	
Mount Vernon *a* *14	99	32	60.3	0.86	
Mount Vernon *b*	100	27	64.0	0.80	
Murray	.....	.....	.....	0.30	
New Hampton	89	22	61.9	1.20	
Newton	99	22	62.9	0.50	
Northboro	.....	.....	.....	0.30	
North McGregor	.....	.....	.....	2.29	
Northwood	92	20	59.4	1.03	
Odebolt	99	20	63.9	0.44	
Ogden	97	22	63.1	1.25	
Olin	96	17	61.4	0.96	
Onawa	102	23	66.0	0.52	
Osage	89	20	60.2	1.93	
Osceola	99	23	64.8	1.07	
Oskaloosa	99	23	63.4	0.83	
Ottumwa	102	26	65.6	1.38	
Ovid	100	23	64.7	0.94	
Pacific Junction	97	20	64.2	0.46	
Pella	91	25	60.7	0.44	
Plover	99	19	63.8	0.44	
Primghar	98	17	60.5	0.00	
Redoak	100	26	67.0	0.80	
Ridgeway	90	26	60.8	1.87	
Rockwell City	97	20	62.0	0.72	
Ruthven	97	17	62.4	1.40	
Sac City	98	21	62.6	0.55	
Scranton	97	24	62.2	0.72	
Sheldon	98	15	59.2	0.06	
Sibley	99	15	59.5	0.22	
Sigourney	103	21	61.0	1.92	
Sioux Center	96	22	62.2	0.15	
Spirit Lake	98	21	62.2	0.30	
Storm Lake	94	22	62.4	0.33	
Stuart	96	24	64.1	.....	
Tara	100	.....	.....	0.75	
Thurman	96	23	64.6	0.78	
Toledo	103	17	64.6	0.45	
Villisca	100	25	63.2	0.57	
Wapello	100	23	63.9	1.24	
Washington	101	24	61.4	0.90	
Washta	.....	.....	.....	0.27	
Waterloo	97	19	61.6	0.84	
Waverly	91	22	60.6	0.95	
Westbend *1	98	20	58.9	0.52	
Westbranch	98	17	61.6	1.36	
West Union	.....	.....	.....	0.81	
Whitten *1	97	30	62.8	0.73	
Wilton Junction	98	18	63.3	1.01	
Winterset	100	24	63.0	1.08	
Woodburn	.....	.....	.....	1.02	
Kansas.					
Achilles	.....	.....	.....	0.32	
Altoona *2	103	38	65.4	1.85	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Kansas—Cont'd.	°	°	°	*Ins.*	*Ins.*
Anthony	.....	.....	.....	3.88	
Atchison *a*	100	31	67.9	1.95	
Atchison *b*	102	31	68.8	1.58	
Augusta	99	36	69.8	2.69	
Baker	99	27	67.2	1.24	
Burlington	99	34	68.4	0.67	
Campbell	102	29	67.8	1.18	
Centropolis *1	103	30	67.1	1.95	
Colby	107	32	67.8	0.75	
Columbus	98	34	69.2	0.98	
Coolidge	102	36	66.8	1.25	
Cunningham	100	37	69.8	3.02	
Delphos	102	33	69.4	2.29	
Dresden	104	34	67.8	1.24	
Ellinwood	101	37	68.1	2.96	
Emporia	95	38	67.2	4.10	
Englewood	101	35	70.0	3.02	
Eskridge	100	34	68.5	1.76	
Eureka	.....	.....	.....	1.99	
Eureka Ranch	103	33	68.8	1.84	
Fallriver	102	34	69.2	2.07	
Fanning	98	25	64.2	1.33	
Fort Scott	104	36	70.7	1.33	
Frankfort	102	27	67.8	1.30	
Garden City	102	38	69.6	1.93	
Garfield	.....	.....	.....	2.14	
Gibson	104	32	69.8	1.04	
Grenola	100	37	69.0	3.02	
Halstead	102	36	68.7	1.97	
Hays	104	32	69.6	2.30	
Horton	99	30	66.9	0.99	
Hutchinson	99	39	69.8	2.31	
Independence	101	37	70.5	0.72	
Lawrence	96	36	67.4	2.73	
Lebanon *c	100	.....	.....	0.00	
Lebo	99	32	68.2	2.21	
Macksville	99	37	69.0	2.77	
McPherson	104	36	69.6	3.07	
Manhattan *b*	103	34	69.4	1.75	
Manhattan *c*	102	29	69.4	1.69	
Marion	99	36	69.5	2.65	
Medicine Lodge	101	39	69.8	3.57	
Minneapolis	103	31	68.8	2.12	
Moran	99	35	69.1	2.40	
Mounthope *1	98	39	69.3	2.24	
Ness City	102	41	70.5	1.40	
Newton	103	35	72.0	2.74	
Norwich	100	38	70.4	4.04	
Oberlin	.....	.....	.....	0.26	
Olathe	100	30	69.6	1.60	
Osage City	100	33	67.8	2.53	
Oswego	102	38	72.4	0.55	
Ottawa	100	32	67.2	1.23	
Paola	101	32	66.0	0.75	
Phillipsburg	108	30	67.6	0.39	
Pratt	100	39	69.6	3.34	
Rome *1	100	40	69.9	2.63	
Russell	101	36	69.2	1.77	
Salina *f	100	36	70.6	1.88	
Scott	103	32	68.2	1.38	
Sedan	100	38	70.1	1.13	
Seneca	100	26	66.6	1.26	
Toronto	103	33	66.9	1.60	
Tribune	103	35	67.6	0.63	
Ulysses	102*	35*	70.2	1.40	
Valley Falls	101	31	67.5	2.92	
Viroqua	101	40	69.0	2.46	
Wakeeney	.....	.....	.....	1.61	
Wallace	.....	.....	.....	1.10	
Wamego *1	101	34	66.4	1.38	
Winfield	100	38	70.2	3.90	
Winona	.....	.....	.....	0.50	
Yates Center	99	34	68.7	1.55	
Kentucky.					
Alpha *2	100	34	67.0	2.68	
Bardstown	104	29	70.6	1.55	
Blandville	95	32	68.0	3.29	
Bowling Green	99	35	71.0	0.71	
Burnside	.....	.....	.....	2.61	
Canton *1	100	36	70.3	0.05	
Carrollton	98	34	71.0	0.90	
Catlettsburg	99	28	65.8	3.79	
Earlington	97	32	68.8	0.66	
Edmonton	97	34	67.6	1.23	
Eubank	101	30	67.3	2.24	
Falmouth	.....	.....	.....	1.54	
Fords Ferry	103	28	69.6	1.41	
Frankfort	98	35	68.8	1.58	
Georgetown	99	33	68.0	.....	
Greensburg	105	29	68.9	0.92	
Henderson	98	33	68.6	0.83	
Hopkinsville	103	31	70.3	0.69	
Irvington	98	29	68.0	1.09	
Jackstown	.....	.....	.....	1.93	
Leitchfield	99	28	67.8	1.07	
Loretto	102	28	68.2	0.98	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Kentucky—Cont'd.	°	°	°	*Ins.*	*Ins.*
Marrowbone	100	30	68.8	4.37	
Maysville	103	31	68.4	2.92	
Middlesboro	98	30	66.6	2.12	
Mount Hermon	96	30	68.0	1.60	
Mount Sterling	97	32	66.6	1.89	
Owensboro	101	32	69.4	1.31	
Owenton	103	31	69.5	1.50	
Paducah *a*	.....	.....	.....	1.51	
Paducah *b*	104	37	72.4	1.36	
Princeton	101	31	69.0	0.45	
Richmond	101	32	69.2	2.31	
Russellville	96	31	68.5	0.52	
St. John	99	27	67.2	0.86	
Scott	102	29	67.8	0.63	
Shelby City	104	30	68.0	2.13	
Shelbyville	103	28	69.1	1.49	
Vanceburg	100	32	65.2	2.05	
Williamsburg	98	32	69.4	3.53	
Louisiana.					
Alexandria	101	40	74.6	1.91	
Amite	99	44	75.1	3.19	
Bastrop	106	38	75.0	0.64	
Baton Rouge	98	46	75.4	1.13	
Calhoun	100	39	73.2	0.49	
Cheneyville	99	40	74.0	7.75	
Clinton	95	41	73.2	0.55	
Como	99	40	72.7	1.10	
Covington	97	43	75.5	2.90	
Donaldsonville	95	49	75.2	1.80	
Elm Hall	94	47	74.6	1.27	
Emilie	93	48	74.6	1.49	
Farmerville	100	38	72.8	0.46	
Franklin	95	47	74.6	3.69	
Grand Coteau	97	44	74.4	3.35	
Hammond	98	43	75.4	1.35	
Houma	95	52	76.7	1.39	
Jeanerette	101	42	74.7	2.20	
Jennings	97	44	74.4	2.25	
Lafayette	98	42	74.8	1.66	
Lake Charles	98	47	76.2	3.79	
Lake Providence	100	45	75.2	1.01	
L'Argent	98	43	74.4	1.28	
Lawrence	96	54	77.6	2.05	
Libertyhill	106	40	75.6	0.29	
Mansfield	104	40	74.0	1.85	
Melville	97	42	74.0	0.55	
Minden	105	40	74.9	1.50	
Monroe	101	43	75.2	0.28	
Montgomery	106	42	74.4	1.75	
New Iberia	94	49	75.1	1.35	
Oakridge *c	102	36	72.4	0.15	
Opelousas	98	42	74.0	1.66	
Paincourtville	97	45	74.7	4.11	
Plain Dealing	103	38	72.2	1.00	
Plaquemine	100	47[h]	76.8[i]	1.65	
Prevost	100	49	78.4	0.31	
Rayne	99	44	75.6	1.31	
Ruston	104	44	75.0	0.48	
Schriever	97	43	75.1	2.98	
Shellbeach	93	48	76.2	2.97	
Southern University	95*	50*	75.8*	0.03	
Sugar Ex. Station	94	52	76.0	0.30	
Sugartown	95	48	75.4	3.76	
Venice	98	55	76.6	7.96	
Wallace	98	46	75.6	0.39	
White Sulphur Springs	99	45	77.0	2.10	
Maine.					
Belfast *6	70	43	57.3	4.80	
Calais	80	24	56.0	2.87	
Cornish *1	80	36	56.6	5.38	
Fairfield	79	30	57.2	3.58	
Farmington	84	26	55.3	3.26	
Flagstaff	84	28	53.8	1.73	
Gardiner	82	33	58.5	3.90	
Lewiston	87	35	58.5	3.65	
Mayfield	81	27	54.0	3.33	
North Bridgton	85	31	57.6	3.95	
Orono	88	23	56.6	3.20	
Petit Menan *1	65	45	54.7	.....	
Rumford Falls	81	30	55.2	3.00	
Winslow	.....	25	.....	4.03	
Maryland.					
Annapolis	91	42	67.8	4.25	
Bachmans Valley	86	37	62.8	7.28	
Boettcherville	97	33	65.4	4.26	
Boonsboro *a*	94	38	66.0	3.64	
Charlotte Hall	95	39	66.6	4.36	
Chase	93	37	65.0	5.75	
Chestertown	89	43	66.0	5.67	
Chewsville	91	31	64.6	4.68	
Clearspring	91	36	63.6	3.75	
Coleman	92	42	68.7	7.45	
Collegepark	87	36	63.7	5.45	
Cumberland	88	40	65.7	4.26	
Darlington	86	40	64.4	4.75	
Deerpark *	88	28	58.6	3.05	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Maryland—Cont'd.	°	°	°	*Ins.*	*Ins.*
Easton	93	41	67.4	4.33	
Ellicott City	90	38	65.2	9.35	
Fallston	87	40	63.8	7.29	
Frederick	91	39	65.8	3.93	
Frostburg	99	36	63.2	4.47	T.
Grantsville	86	31	58.6	3.77	
Greatfalls	90	38	65.4	4.27	
Greenspring Furnace	94	36	64.4	3.08	
Hancock	97	32	64.4	2.89	
Harney	.....	.....	.....	4.23	
Jewell	93	42	66.4	4.81	
Johns Hopkins Hospital	94	41	66.0	7.21	
Laurel	95	37	65.6	5.49	
McDonogh	88	35	64.2	9.43	
Mardela Springs	92	40	67.0	3.68	
Mount St. Marys Coll.	90*	40[j]	65.4[g]	5.28	
Newmarket	91	40	65.2	5.29	
Pocomoke City	94	43	68.4	0.80	
Princess Anne	94	35	65.8	.....	
Queenstown	90	39	66.2	4.08	
Rockhall *b*	90	41	65.0	3.37	
Sandy Point	95	42	70.6	0.87	
Sharpsburg *	92	39	63.4	4.04	
Solomons	99	47	71.4	5.17	
Sudlersville	89	43	66.0	3.58	
Sunnyside	90	25	58.8	3.76	T.
Takoma Park	95	39	66.9	5.95	
Taneytown	80[k]	38	68.6[f]	4.86	
Van Bibber	88	35	63.9	7.00	
Westernport	90	29	62.0	4.05	
Woodstock	88	37	64.0	5.96	
Massachusetts.					
Adams	80	35	58.1	.....	
Amherst	84	33	59.2	6.97	
Attleboro	.....	.....	.....	10.21	
Bedford	81	35	58.4	3.72	
Bluehill (summit)	81	39	60.2	7.55	
Cambridge	86	39	62.2	4.31	
Chestnuthill	85	36	62.0	5.38	
Cohasset	.....	.....	.....	7.88	
Concord	85	33	58.8	4.01	
Dudley[1]	83*	37	61.5	3.75	
East Templeton *1	84	37	57.6	3.89	
Fallriver	78	42	62.2	6.64	
Fiskdale	.....	.....	.....	3.81	
Fitchburg *a* *1	78	40	57.8	4.72	
Fitchburg *b*	84	34	58.8	4.82	
Framingham	87	35	61.6	3.78	
Groton	82	31	58.6	3.89	
Hyannis *1	78	42	61.1	2.58	
Jefferson	.....	.....	.....	3.84	
Lawrence	82	37	60.8	3.98	
Leeds	83	33	57.9	6.87	
Leicester	82	35	58.4	3.07	
Leominster	.....	.....	.....	4.49	
Longplain	.....	.....	.....	6.99	
Lowell *a*	82	36	61.0	3.66	
Lowell *b*	81	35	59.8	.....	
Ludlow Center	80	30	56.2	4.40	
Middleboro	80	33	59.8	7.12	
Monson	81	34	59.6	3.29	
New Bedford *a*	78	42	61.5	6.50	
New Salem	82	36	57.8	5.98	
Pittsfield	78	34	58.7	5.82	
Plymouth *1	76	41	58.1	6.93	
Princeton	.....	.....	.....	4.15	
Provincetown	85	44	64.4	4.85	
Salem	.....	.....	.....	6.11	
Somerset *1	88	38	64.4	6.76	
South Clinton	.....	.....	.....	4.63	
Springfield Armory	85	37	61.4	3.33	
Sterling	.....	.....	.....	3.82	
Taunton *c*	78	32	59.6	9.05	
Webster	.....	.....	.....	3.95	
Westboro	85	34	61.7	4.04	
Weston	83	34	59.2	4.84	
Williamstown	79	33	57.5	5.31	
Winchendon	.....	.....	.....	4.57	
Worcester *b*	81	36	60.2	4.20	
Michigan.					
Adrian	94	29	59.2	3.24	
Agricultural College	94	21	57.0	2.14	
Allegan	.....	.....	.....	1.54[d]	T.
Alma	93	27	56.8	2.72	T.
Ann Arbor	96	27	59.7	2.68	
Arbela	90	23	55.8	5.18	T.
Badaxe	91	31	58.8	3.51	
Baldwin	91	.....	.....	2.50	
Ball Mountain	95	28	59.3	3.27	
Baraga	85	26	54.6	2.70	
Battlecreek	94	28	59.8	2.53	T.
Bay City	91	26	57.4	3.73	
Berlin	93	26	57.4	4.18	
Berrien Springs	99	31	61.4	2.30	1.0
Big Point Sable *10	78	34	56.7	.....	
Big Rapids	89	25	55.2	2.64	

TABLE II.—*Climatological record of voluntary and other cooperating observers.*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Michigan—Cont'd.	°	°	°	*Ins.*	*Ins.*
Birmingham	96	21	58.4	2.62	
Boon	87	23	52.6	3.35	1.5
Calumet	78	28	50.8	3.08	2.0
Carsonville	90	28	57.8	3.60	
Charlevoix	89	32	57.8	2.90	T.
Cheboygan	91	29	56.2	3.50	T.
Clinton	96	29	61.4	2.94	
Coldwater	94	28	59.3	2.29	T.
Eagle Harbor	80	33	52.2	2.86	T.
East Tawas	87	28	55.8	1.83	
Eloise	95	30	61.8	2.21	
Ewen	80	30	51.2	1.50	6.0
Fairview	91	31	60.0	3.48	
Fitchburg	96	26	59.6	1.60	
Flint	92	28	57.4	5.06	
Gladwin	90	26	56.0	1.60	T.
Grand Rapids	98	31	60.6	3.90	
Grape	96	28	62.8	2.23	
Grayling	88	24	52.8	1.85	2.0
Hanover	95	27	60.2	3.34	
Harbor Beach	92	21	57.4	2.84	
Harrison	97	28	56.7	1.85	T.
Harrisville	87	29	55.3	2.41	
Hart	91	30	56.8	3.02	1.0
Hastings	95	25	58.6	3.64	
Hayes	92	30	58.4	2.91	
Highland Station	.....	.....	.....	2.08	T.
Hillsdale	93	26	59.2	3.13	T.
Holland *10	83	36	60.6	.....	
Howell	.....	.....	.....	1.25	
Humboldt	84	23	47.6	5.31	1.0
Ionia	96	28	59.5	3.30	
Iron Mountain	89	25	52.5	2.48	T.
Iron River	83	19	52.4	2.01	T.
Ishpeming	85	26	51.0	4.93	4.0
Ivan	89	26	53.8	2.40	1.5
Jackson	96	27	60.4	2.89	
Jeddo	92	28	56.2	3.38	
Kalamazoo	95	30	61.2	3.45	
Lake City *	97	27	55.8	2.50	
Lansing	95	23	57.4	2.34	T.
Lapeer	93	23	57.8	4.65	
Lathrop	86	24	49.6	5.28	8.0
Ludington	84	24	54.7	.....	0.7
Luzerne	87	22	53.1	2.32	
Mackinaw	89	28	55.3	5.27	T.
Madison	93	29	61.0	2.59	
Mancelona	88	26	52.0	3.38	6.0
Menominee	90	27	55.8	2.06	T.
Middle Island *10	78	38	55.8	.....	
Midland	.....	.....	.....	2.01	
Mottville	99	29	61.2	2.27	T.
Mount Clemens	96	28	59.9	2.11	
Mount Pleasant	.....	.....	.....	3.02	T.
Muskegon	87	34	58.6	4.23	T.
Newberry	82	22	48.6	5.24	T.
North Manitou Island *10	83	34	56.2	.....	
Northport	86	27	56.3	1.94	T.
Old Mission	90	30	57.0	2.49	T.
Olivet	92	30	59.1	2.89	T.
Omer	.....	.....	.....	1.75	
Ovid	93	28	58.3	4.01	
Owosso	97	27	58.9	2.99	
Petoskey	88	29	54.5	2.38	T.
Plymouth	96	28	60.2	3.12	
Port Austin	91	32	58.4	3.00	
Reed City	91	25	55.3	2.33	T.
Romeo	90	29	59.4	2.56	
Saginaw	95	28	58.7	2.93	
St. Ignace	87	29	53.8	1.98	T.
St. Johns	92	27	59.2	3.40	T.
St. Joseph	93	32	62.2	2.31	0.2
Somerset	92	27	59.5	3.02	
South Haven	89	32	60.3	2.88	T.
Stanton	92	24	56.5	4.12	T.
Thomaston	80	.....	.....	2.53	2.0
Thornville	98	29	59.0	2.83	T.
Traverse City	92	32	58.7	1.83	0.5
Vandalia	96	30	62.0	3.51	T.
Vassar	94	27	57.4	1.90	
Vermilion Point *10	80	26	49.7	.....	
Wasepi	92	29	60.4	3.35	T.
Waverly	90	28	58.9	5.16	T.
West Harrisville	86	28	54.0	3.34	
Wetmore	85	22	49.8	5.83	2.0
Whitecloud	91	25	59.0	3.25	
Ypsilanti	93	28	58.6	3.01	
Minnesota.					
Ada	86*	28*	56.4*	1.73	2.0
Albert Lea	92	24	60.2	1.02	T.
Alexandria	84	25	55.0	0.91	
Ashby	85	21	56.1	1.12	0.3
Beardsley	89	18	56.8	0.78	
Bemidji	81	22	53.0	2.40	2.0
Bird Island	96	17	58.1	0.88	
Blooming Prairie	89	18	57.4	1.10	T.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Minnesota—Cont'd.	°	°	°	*Ins.*	*Ins.*
Brainerd	86	21	55.3	2.60	T.
Caledonia	87	20	56.9	1.62	
Campbell	84	17	54.0	1.21	
Collegeville	86	26	58.1	0.85	T.
Crookston	86	23	54.4	1.03	.....
Deephaven	.....	.....	.....	1.31	
Detroit City	84	15	53.4	0.82	2.0
Farmington	87	20	57.4	1.33	T.
Fergus Falls	87	21	55.6	1.88	0.5
Glencoe	87	19	57.2	1.10	
Grand Meadow	91	25	57.8	1.51	T.
Granite Falls *	89	15	56.0	1.00	
Hallock	86	13	53.7	0.21	
Lake City	87	21	59.0	2.20	
Lakeside	92	30	56.4	0.27	T.
Lake Winnibigoshish [1]	77	27*	53.7	3.79	
Leech	82	21	54.2	2.59	T.
Leroy	88	20	60.0	1.30	
Long Prairie	87	18	54.4	1.12	T.
Luverne	93	24	58.0	0.24	
Lynd	92c	33c	61.8c	0.26	
Mapleplain [1]	88	23*	57.2c	1.72	T.
Milaca	88	20	55.8	1.72	
Milan	92	14	57.1	0.19	
Minneapolis *a*	89	23	57.4	1.35	T.
Minneapolis *b* [1]	85*	19	56.0	1.23	
Minnesota City *[1]	85	20	58.9	1.28	
Montevideo	95	14	55.8	0.17	
Morris	90	20	57.5	0.78	
Mount Iron	76	18	49.8	4.34	0.5
Newfolden	82	17	52.6	1.50	0.1
New London	88	22	58.8	0.32	
New Richland *[1]	88	32	58.7	.....	
New Ulm	98	21	58.4	1.24	
Park Rapids	80	20	52.0	1.73	2.2
Pine River	81	20	53.4	3.07	T.
Pipestone	.....	15	.....	0.19	
Pleasant Mounds	96	19	59.2	0.15	
Pokegama Falls	81	17	51.7	2.83	2.1
Reeds	.....	.....	.....	1.61	
Rolling Green	93	18	58.7	0.28	
Roseau [1]	80	23	54.1	0.92	
St. Charles	87	22	57.2	1.26	
St. Cloud	85	24	58.2	0.95	
St. Peter	89	25	58.9	0.50	
Sandy Lake Dam	79	25	53.5	2.67	0.3
Shakopee	90	19	59.4	1.19	
Tower	80	15	50.9	3.55	2.0
Two Harbors	83	25	54.0	3.67	T.
Wabasha *[1]	87	25	58.1	2.04	
Willmar	87	21	56.7	0.55	
Willow River	84	18	54.0	5.26	T.
Winnebago City	97	22	60.1	0.75	
Worthington	92	22	59.0	0.26	
Zumbrota [1]	86*	18	58.0	.....	
Mississippi.					
Aberdeen	96	36	70.4	0.15	
Agricultural College	97	43	73.8	1.15	
Americus	98	47	76.1	1.65	
Austin	94	37	70.6	0.93	
Batesville	97	34	70.2	0.94	
Bay St. Louis	95	52	76.6	1.68	
Biloxi	90	44	70.7	0.43	
Booneville	99	36	71.6	0.11	
Brookhaven	102	41	73.8	2.00	
Canton	101	38	72.8	0.57	
Columbus *a*	.....	.....	.....	0.16	
Columbus *b*	95	40	72.9	0.12	
Corinth	96	38	71.2	0.28	
Crystalsprings	99	43	73.8	1.22	
Edwards	97	44	74.0	2.89	
Fayette	95	41	73.0	1.75	
Fayette (near) *[1]	99	49	74.8	.....	
Greenville *a*	96	46	72.6	1.15	
Greenville *b*	98	45	73.8	1.18	
Greenwood	96	41	72.0	1.95	
Hattiesburg	95	45	74.6	0.80	
Hazlehurst	.....	45	.....	1.22	
Hernando	97	41	72.2	0.00	
Holly Springs	99	40	72.9	0.10	
Jackson	105	43	76.6	2.75	
Lake	98	37	70.8	0.80	
Leakesville	100	37	74.8	0.55	
Logtown	95	46	75.5	0.50	
Louisville	101	38	71.9	2.00	
Macon	99	38	72.5	0.06	
Magnolia	97	42	73.6	1.94	
Natchez	100	47	75.7	1.15	
Okolona	102	37	72.4	0.02	
Palo Alto	98	38	72.9	0.04	
Pontotoc	101	38	72.6	0.78	
Port Gibson	98	37	73.6	2.24	
Ripley	100	34	70.4	0.80	
Stonington *[1]	92	44	73.7	.....	
Thornton	.....	.....	.....	1.65	
Tupelo	.....	.....	.....	0.88	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Mississippi—Cont'd.	°	°	°	*Ins.*	*Ins.*
University	100	38	73.4	2.00	
Walnutgrove	.....	.....	.....	3.85	
Watervalley *[1]	100	39	70.7	0.29	
Waynesboro	95	40	72.6	0.50	
Windham	99	38	73.3	0.11	
Woodville	97	45	74.0	1.10	
Yazoo City	105	39	73.7	1.87	
Missouri.					
Appleton City	104	34	70.4	1.68	
Arthur *[3]	.....	40	65.2	1.35	
Avalon	98	29	67.2	1.89	
Bethany	103	23	65.4	1.26	
Birchtree	100	28	68.0	0.77	
Boonville	.....	.....	.....	1.34	
Brunswick	95	32	65.2	1.81	
Carrollton	98	33	66.8	2.00	
Conception	95	32	65.4	1.21	
Cook Station	107	21	67.4	0.70	
Cowgill *[5]	100	30	66.3	2.03	
Darksville	99	32	64.6	1.75	
Downing	.....	.....	.....	3.87	
East Lynne *[3]	...	32	62.9	0.61	
Edgehill *[5]	98	28	64.8	3.23	
Eightmile *[1]	95	32	66.5	0.54	
Eldon	103	31	67.4	3.74	
Elmira	99	26	64.2	1.56	
Fairport	.....	.....	.....	1.42	
Fayette	101	30	66.8	2.72	
Fulton	.....	.....	.....	3.25	
Galena	.....	.....	.....	2.93	
Gallatin *[1]	100	30	67.1	1.47	
Gayoso	99	32	69.2	1.26	
Glasgow	100	30	66.6	2.04	
Gorin	.....	.....	.....	3.44	
Halfway	103	31	69.4	2.72	
Harrisonville	102	29	67.8	0.50	
Hazlehurst	.....	.....	....	2.02	
Hermann	.....	.....	.....	3.84	
Houston	102	29	66.7	0.88	
Houstonia (near)	.....	.....	.....	1.41	
Irena	.....	.....	.....	0.96	
Ironton	104	23	66.9	2.76	
Jackson *[3]	95	34	67.0	2.48	
Jefferson City	105	29	68.2	3.16	
Kidder	100	26	66.0	2.45	
Lamar	102	33	70.0	2.59	
Lamonte	.....	.....	.....	1.21	
Lebanon	103	35	70.0	1.38	
Lexington	100	31	68.2	1.70	
Liberty	99	28	66.8	1.44	
Louisiana	105	25	67.0	3.56	
McCune *[1]	100	34	65.4	4.40	
Macon	102	27	66.8	1.52	
Marblehill	103	24	67.8	2.04	
Marshall	100	29	65.8	2.09	
Maryville	99	28	65.2	0.92	
Mexico	108	29	68.2	4.35	
Miami *[5]	98	33	67.0	1.58	
Mineralspring	99	30	68.2	0.75	
Montreal	102	29	67.8	2.87	
Mount Vernon	103	32	72.2	3.01	
Neosho	100	30	68.4	2.32	
Nevada	101	31	68.6	2.65	
New Haven	105	29	68.6	2.76	
New Madrid	99	32	71.2	1.70	
New Palestine	102	30	68.4	2.64	
Oakfield	104	30	68.9	1.97	
Olden	101	29	67.0	1.15	
Oregon *a*	97	30	66.4	1.09	
Oregon *b*	100	32	69.3	1.26	
Palmyra *[5]	100	30	65.7	2.42	
Phillipsburg *[1]	104	33	67.1	0.85	
Poplarbluff	101	31	70.0	2.32	
Potosi	101	16	62.0	2.39	
Princeton	102	27	66.4	1.10	
Rhineland	104	25	67.6	1.97	
Richmond	98	33	67.4	1.69	
Rolla	.....	.....	.....	1.40	
St. Charles	103	31	68.2	1.62	
St. Joseph	.....	.....	....	1.40	
Sarcoxie *[3]	.....	32	66.5	2.99	
Sedalia	103	27	68.2	1.77	
Seymour	100	31	67.6	1.97	
Shelbina	.....	.....	.....	3.00	
Sikeston	100	29	69.3	2.72	
Steffenville	101	28	65.6	1.48	
Stellada	102	31	68.4	1.01	
Sublett	87	25	63.8	3.05	
Trenton	95	30	66.1	1.85	
Unionville	103	26	67.0	2.47	
Vichy	105	31	71.6	1.02	
Warrensburg	100	30	68.4	0.74	
Warrenton	105	29	67.0	4.25	
Wheatland	.....	.....	.....	0.81	
Willowsprings	104	28	69.3	1.00	
Wylie	102	32	70.5	2.84	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Missouri—Cont'd.	°	°	°	*Ins.*	*Ins.*
Zeltonia	102	27	67.3	1.99	
Montana.					
Adel	85	21	51.9	1.29	
Boulder	82	27	54.0	0.62	
Canyon Ferry	86	35	59.8	0.64	
Chinook	88	28	57.9	0.00	
Columbia Falls	83	33	55.1	2.31	
Corvallis	90	30	63.6	0.08	
Crow Agency	91	30	60.4	0.17	
Deerlodge	87	26	54.4	.....	
Ekalaka [4]	89	21	59.8	0.18	
Fort Benton	90	34	61.4	1.26	
Fort Keogh	97	30	61.4	0.30	
Fort Logan	80	28	54.2	0.30	
Glasgow	90	23	58.0	0.00	
Glendive	94	29	61.3	0.05	
Glenwood	84	29	55.8	0.11	
Greatfalls	83	37	59.6	0.76	
Kipp	87	24	53.8	3.15	T.
Manhattan	85	23	54.5	0.16	
Martinsdale	85	29	57.4	0.05	
Marysville	84	33	56.4	0.58	
Missoula	87	34	59.3	1.60	
Ovando	88	22	53.2	0.93	
Parrot	85	33	57.7	0.28	
Plains	85	34	59.2	1.48	
Poplar	89	27	58.6	T.	
Ridge	90	25	59.6	0.87	
St. Pauls	87	32	59.8	.....	
Troy	87	31	57.8	2.34	
Utica	92	33	59.6	0.28	
Wibaux	88	31	57.4	0.28	
Yale	88	25	55.6	0.18	
Nebraska.					
Agee [*1]	.....	.....	.....	0.10	
Albion	99	20	60.8	0.83	
Alliance	.....	.....	.....	0.00	
Alma	104	28	66.6	0.21	
Ansley	100	21	62.0	0.95	
Arborville [*1]	106	36	66.2	1.13	
Ashland *a*	102	23	67.0	0.58	
Ashland *b* [*1]	104	29	67.9	0.50	
Ashton	.....	.....	.....	0.89	
Auburn	100	21	65.4	0.70	
Aurora [*1]	104	28	63.1	0.90	
Bartley	.....	.....	.....	0.46	
Beatrice	100	24	65.4	0.52	
Beaver City	108	28	68.4	0.43	
Bellevue	.....	.....	.....	0.51	
Benedict	.....	.....	.....	1.27	
Benkleman	.....	.....	.....	T.	
Blair	99	28	64.4	0.51	
Bluehill	.....	.....	.....	0.39	
Bradshaw	.....	.....	.....	1.18	
Brokenbow	.....	.....	.....	0.60	
Burchard	.....	.....	.....	0.82	
Burwell	.....	.....	.....	0.54	
Callaway	102	25	61.4	0.75	
Camp Clarke	103	30	65.7	T.	
Central City	.....	.....	.....	1.02	
Chester	.....	.....	.....	0.42	
Clatonia	103	26	67.8	1.43	
Columbus	99	25	64.2	0.93	
Creighton	94	18	60.7	0.10	
Crete	100	23	64.4	0.43	
Culbertson	.....	.....	.....	0.03	
Curtis *a*	102[3]	24[3]	66.3[3]	0.55	
David City	101	27	64.0	1.10	
Dawson	100	27	63.4	1.09	
Eden	.....	.....	.....	0.87	
Edgar *a*	.....	.....	.....	0.00	
Elba	.....	.....	.....	0.61	
Ericson [*1]	102	32	64.2	0.56	
Ewing	.....	.....	.....	0.00	
Fairbury	103	23	66.2	0.58	
Fairfield	104	26	66.8	0.50	
Fairmont	103	23	67.2	0.15	
Fort Robinson	99	30	60.9	0.50	
Fremont	100	24	63.8	0.61	
Geneva	99	23	65.2	0.17	
Genoa	104	25	65.5	0.51	
Gering	100	27	63.3	0.19	
Gordon	.....	.....	.....	0.30	
Gothenburg	102	28	63.6	0.60	
Grand Island *a*	.....	.....	.....	0.45	
Grand Island *b*	104	25	66.4	0.53	
Grand Island *c*	105	23	65.2	0.66	
Greeley	.....	.....	.....	1.05	
Haigler	.....	.....	.....	0.00	
Hartington	98	21	61.6	0.44	
Harvard	100	27	65.7	0.78	
Hastings [*1]	101	34	65.6	0.86	
Hayes Center	.....	.....	.....	0.12	
Hay Springs	98	27	62.0	0.41	
Hebron	103	27	67.4	0.89	
Hickman	.....	.....	.....	0.53	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Nebraska—Cont'd.	°	°	°	*Ins.*	*Ins.*
Holdrege	.....	.....	.....	0.70	
Hooper [*1]	98	26	62.7	1.53	
Imperial	103	30	65.6	0.18	
Johnstown	.....	.....	.....	T.	
Kearney	.....	.....	.....	0.85	
Kennedy	95	25	62.2	0.00	
Kimball	97	28	62.9	0.00	
Kirkwood [*1]	91	31	60.8	0.30	
Lexington	102	25	64.2	0.65	
Lincoln *b*	102	26	66.5	0.58	
Lincoln *d*	103	25	67.4	0.60	
Lodgepole	99	27	62.9	0.00	
Loup [*1]	104	22	62.3	1.36	
Lynch	93	18	61.3	0.17	
Lyons	.....	.....	.....	0.72	
McCook	.....	.....	.....	0.20	
Madison	99	21	63.6	0.72	
Madrid [*5]	102	28	61.0	0.00	
Marquette	.....	.....	.....	1.16	
Merriman	.....	.....	.....	0.00	
Minden *a*	104	25	66.6	0.90	
Minden *b*	.....	.....	.....	1.14	
Monroe	.....	.....	.....	0.50	
Nebraska City *b*	.....	.....	.....	0.60	
Nebraska City *c*	100	26	72.0	0.92	
Nemaha [*1]	99	30	66.6	0.64	
Nesbit	96	25	64.0	0.80	
Norfolk *b*	101	20	62.6	0.86	
North Loup	103	24	65.0	0.89	
Oakdale	102	20	62.4	1.57	
Odell	.....	.....	.....	1.52	
O'Neill	96	19	60.7	0.70	
Ord	.....	.....	.....	0.63	
Osceola	.....	.....	.....	1.10	
Ough	.....	.....	.....	0.00	
Palmer *b* [*2]	100	28	67.9	0.52	
Palmyra	.....	.....	.....	0.69	
Paxton	.....	.....	.....	0.25	
Plattsmouth *b*	.....	.....	.....	0.46	
Pleasanthill	.....	.....	.....	0.15	
Ravenna *a*	102	22	64.8	0.45	
Ravenna *b*	.....	.....	.....	0.28	
Redcloud *a*	.....	.....	.....	0.14	
Redcloud *b*	100	25	66.7	0.09	
Republican	.....	.....	.....	0.25	
Rulo	.....	.....	.....	0.55	
St. Libory	.....	.....	.....	0.52	
St. Paul	.....	.....	.....	0.74	
Salem [*1]	96	38	66.6	0.80	
Santee	95	23	66.0	T.	
Sargent	.....	.....	.....	0.32	
Schuyler	.....	.....	.....	0.90	
Seneca [*1]	88	27	61.4	0.00	
Seward [*1]	102	35	65.6	0.20	
Smithfield	.....	.....	.....	0.71	
Spragg	.....	.....	.....	0.20	
Springview	94	37	65.8	0.30	
Stanton [*1]	96°	28°	61.6°	0.41	
State Farm	104	22	66.9	0.62	
Strang	.....	.....	.....	T.	
Stratton	.....	.....	.....	0.20	
Superior [*5]	102	32	65.9	T.	
Syracuse	.....	.....	.....	0.62	
Tablerock	.....	.....	.....	1.24	
Tecumseh *b*	102	24	63.5	0.19	
Tecumseh *c*	.....	.....	.....	0.76	
Tekamah	99	23	64.4	0.75	
Thedford	.....	.....	.....	0.18	
Turlington	100	27	66.6	0.75	
Valentine	96	27	63.1	0.10	
Wakefield	102	17	63.1	0.37	
Wallace	.....	.....	.....	0.20	
Wauneta	.....	.....	.....	0.00	
Weeping Water [*1]	97	18	61.3	0.38	
Wellfleet	.....	.....	.....	0.80	
Westpoint	100	30	66.0	0.80	
Whitman	.....	.....	.....	0.00	
Wilber [*1]	100	30	65.5	0.39	
Willard	.....	.....	.....	0.57	
Wilsonville [*1]	102	32	67.0	0.00	
Wisner	.....	.....	.....	0.58	
Wymore [*1]	98	27	65.2	1.46	
York [*1]	101	28	65.4	0.55	
Nevada.					
Battle Mountain [*1]	88	44	65.6	0.00	
Beowawe [*1]	92	49	64.2	0.00	
Candelaria	93	40	69.0	T.	
Carlin [*1]	91	30	63.3	0.00	
Carson City	90	32	60.9	0.00	
Clover Valley	.....	.....	.....	0.28	
Cranes Ranch	.....	.....	.....	0.00	
Elko [*1]	90	38	57.2	0.00	
Elko (near)	86	31	57.6	T.	
Ely	86	33	58.8	0.16	
Empire Ranch	90	30	56.9	T.	
Fenelon	.....	.....	.....	0.40	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Nevada—Cont'd.	°	°	°	*Ins.*	*Ins.*
Golconda [*1]	84	40	58.0	T.	
Halleck [*1]	95	29	55.4	0.00	
Hawthorne *b*	93	41	65.8	0.00	
Hot Springs	.....	.....	.....	0.00	
Humboldt [*1]	88	47	66.6	0.01	
Lee	.....	.....	.....	0.16	
Lewers Ranch	90	36	61.4	0.00	
Los Vegas	94	51	71.2	0.00	
Lovelocks [*1]	92	49	64.7	0.00	
Martins	87	32	62.8	0.00	
Mill City [*1]	95	38	63.9	0.00	
Monitor Mill	88	33	58.9	0.16	
Palisade [*1]	89	44	63.5	0.00	
Palmetto	90	30	67.3	T.	
Reno State University	90	38	64.2	T.	
Silverpeak	98	44	71.4	0.00	
Sodaville	96	44	70.7	T.	
Tecoma [*1]	95	42	57.4	0.00	
Toano [*1]	88	35	65.9	0.00	
Tuscarora	84	34	58.0	0.00	
Tybo	86	42	66.5	T.	
Verdi [*1]	88	40	63.0	0.00	
Wadsworth [*1]	88	36	64.1	0.00	
Wells	85	24	53.8	0.20	
New Hampshire.					
Alstead	.....	.....	.....	3.77	
Berlin Mills	86	27	54.0	3.84	
Bethlehem	78	30	55.3	3.83	
Brookline [*1]	86	30	58.4	5.71	
Claremont	84	28	59.2	3.16	
Concord	81	28	57.2	4.38	
Durham	80	33	58.0	5.12	
Grafton	82	23	55.0	3.48	
Hanover	84	28	56.8	4.14	
Keene	83	27	57.6	3.83	
Littleton	80	29	55.4	3.43	T
Nashua	85	32	60.4	4.45	
Newton	82	31	57.8	4.83	
North Conway	83	30	56.9	3.00	
Peterboro	85	27	57.0	5.19	
Plymouth	81	25	55.6	3.09	
Sanbornton	81	29	56.0	3.14	
Stratford	84	25	55.8	2.30	
New Jersey.					
Asbury Park	87	42	65.9	3.62	
Bayonne	89	44	66.4	4.77	
Belvidere	89	32	61.2	7.68	
Bergen Point	86	45	65.4	5.06	
Beverly	91	39	66.1	4.83	
Billingsport [*1]	87	48	65.3	4.77	
Boonton	89	33	62.0	6.04	
Bridgeton	93	39	66.6	4.96	
Camden	85	43	64.8	3.65	
Cape May C. H.	93	41	66.9	2.88	
Charlotteburg	85	30	60.0	5.73	
Chester	86	35	61.8	7.19	
Clayton	90	37	65.1	3.62	
College Farm	88	39	64.6	7.80	
Deckertown	84	34	61.8	8.06	
Dover	88	34	61.4	6.34	
Egg Harbor City	89	37	64.1	3.66	
Elizabeth	88	40	65.1	6.14	
Englewood	88	39	62.0	6.61	
Flemington	91	37	64.0	9.61	
Freehold	82	41	63.9	3.85	
Friesburg	89	40	65.8	3.72	
Hammonton	.....	.....	.....	4.29	
Hanover	83	36	62.6	7.71	
Hightstown [4]	85	42	66.7	4.79	
Imlaystown	90	42	66.7	5.07	
Lambertville	89	40	65.4	8.10	
Lebanon	.....	.....	.....	7.60	
Moorestown	88	40	65.0	4.12	
Mount Pleasant	.....	.....	.....	8.58	
Newark	86	42	63.6	6.49	
New Brunswick	89	40	66.4	8.92	
Newton	87	34	61.8	6.21	
Ocean City	90	42	65.6	5.97	
Oceanic	84	42	64.2	4.73	
Paterson	86	41	65.1	6.05	
Perth Amboy	87	43	65.1	8.19	
Plainfield	88	36	63.4	8.87	
Port Norris	.....	.....	.....	3.48	
Rancocas	.....	.....	.....	4.74	
Rivervale	88	33	61.4	5.69	
Rocktown	.....	.....	.....	8.31	
Roseland	88	35	61.4	6.93	
Salem	92	42	66.8	4.52	
Somerville	90	37	64.8	7.18	
South Orange	83	40	62.6	6.99	
Staffordville	.....	.....	.....	6.56	
Toms River	90	35	64.4	4.38	
Trenton	88	41	66.6	4.06	
Tuckerton	87	38	64.3	6.32	
Vineland	89	40	65.4	4.16	
Woodbine	90	39	65.0	3.95	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
New Mexico.	°	°	°	*Ins.*	*Ins.*
Albert	100	45	69.8	2.40	
Albuquerque	93	45	69.0	1.20	
Alma	101	42	68.3	1.10	
Aztec	93	38	65.3	0.61	
Bellranch	.....	.....	.....	2.54	
Bernalillo	94	45	69.6	1.70	
Bluewater	94	30	62.5	0.90	
Cambray	.....	.....	.....	0.98	
Deming	.....	.....	.....	0.54	
East Lasvegas	90	36	60.6	2.87	
Eddy	100	48	74.5	0.95	
Engle	97	46	70.0	0.20	
Espanola	95	38	66.1	1.23	
Folsom	92	35	61.6	4.33	
Fort Bayard	100	41	68.2	1.23	
Fort Union	92	35	62.2	4.92	
Fort Wingate	92	40	66.4	0.85	
Gage	.....	.....	.....	0.15	
Galisteo	100	37	67.6	2.09	
Gallinas Spring	95	40	66.0	1.72	
Gila	102	46	73.3	1.17	
Hillsboro	91	48	69.2	0.00	
Las Vegas Hotsprings	91	36	61.9	3.08	
Lordsburg	.....	.....	.....	1.18	
Lower Penasco	90	45	67.8	2.90	
Mesilla Park	101	36	68.8	0.77	
Monero	88	31	56.2	2.45	
Raton	92	38	61.9	4.17	
Rincon	102	46	72.4	0.92	
Roswell	97	41	70.2	3.64	
San Marcial	97	42	70.2	0.40	
Socorro	99	43	69.6	0.88	
Strauss	.....	.....	.....	1.79	
Whiteoaks	89	42	65.8	0.82	
Winsors Ranch	85	23	52.2	3.24	
New York.					
Adams	.....	.....	.....	2.12	
Addison	87	34	58.6	4.25	T.
Akron	.....	.....	....	4.94	T.
Alfred	84	35	59.4	3.12	T.
Angelica	86	30	58.1	2.86	T.
Appleton	86	38	59.6	6.29	T.
Arcade	85	33	57.2	5.10	0.5
Atlanta	.....	.....	.....	2.54	
Auburn	89	33	61.1	4.12	
Avon	91	34	59.0	2.85	
Baldwinsville	86	37	60.0	3.03	
Bedford *a*	83	33	60.6	5.03	
Bedford *b*	.....	.....	.....	5.18	
Bolivar	88	26	55.9	3.14	T.
Bouckville	85	36	58.0	2.28	
Boyds Corners	.....	.....	.....	8.86	
Brentwood	80[r]	32[r]	60.8[r]	6.00	
Caldwell	78	36	59.6	8.23	
Canajoharie	87	32	58.9	2.27	
Canton	88	31	57.2	3.08	T.
Carmel	83	41	62.5	7.78	
Carvers Falls	82	30	58.2	6.70	
Catskill	83	38	61.8	6.46	
Charlotte[*10]	86	39	59.4	.....	
Chenango Forks	.....	.....	.....	1.60	
Cherrycreek	.....	.....	.....	8.11	T.
Cooperstown	83	32	57.5	3.17	
Cortland	86	30	59.5	2.40	T.
Cutchogue	86	44	63.6	8.47	
Dekalb Junction	.....	.....	.....	3.63	
Dryden	88	31	57.2	2.31	T.
Easton	.....	.....	.....	5.88	
Elmira	90	35	61.0	3.23	
Fayetteville	.....	.....	.....	1.98	
Fleming	88	40	60.4	1.87	
Fort Niagara	85	38	61.0	5.31	
Franklinville	89	29	56 6	3.84	T.
Fulton	.....	.....	.....	3.83	
Garrattsville	84	32	57.6	3.88	
Glens Falls	81	36	59.8	7.10	
Gloversville	84	29	57.3	3.26	T.
Greenwich	81	33	59.8	5.89	
Haskinville	.....	.....	.....	2.68	T.
Hemlock	86	38	59.4	2.45	
Honeymead Brook	84	35	59.7	5.66	
Hopewell	87	27	59.5	2.23	
Humphrey	84	32	57.5	4.71	4.5
Indian Lake	81	30	56.2	2.84	
Ithaca	91	36	59.2	2.16	T.
Jamestown	83	34	58.8	4.83	2.0
Keene Valley	82	27	55.4	6.54	
King Station	.....	.....	.....	8.80	
Lakehill	80	35	57.0	9.23	
Liberty	78	36	57.4	7.85	
Littlefalls	82	37	58.7	2.59	T.
Lockport	82	36	58.0	4.33	T.
Lowville	86	26	57.2	2.05	T.
Lyndonville	.....	.....	.....	4.60	
Lyons	88	29	60.0	2.45	
Madison Barracks	88	29	58.0	3.20	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
New York—Cont'd.	°	°	°	*Ins.*	*Ins.*
Mayle	.....	.....	.....	8.21	
Middletown	80	39	61.4	7.89	
Mohonk Lake[1]	80[s]	35	61.8	8.90	
Mount Morris	88	30	56.6	1.74	T.
Newark Valley	.....	.....	.....	1.87	
New Lisbon	85	26	55.5	3.25	T.
North Germantown	84	38	62.2	6.17	
North Hammond	86	40	59.8	3.90	
North Lake	81	29	55.8	3.03	T.
Number Four	80	28	55.0	3.14	0.2
Nunda	90	33	59.3	2.83	T.
Ogdensburg	83	36	58.2	3.49	
Oneonta	83	30	56.4	4 96	
Oxford	87	28	57.6	3.05	
Palermo	87	31	58.9	3.60	
Penn Yan	93	35	61.0	2.75	T.
Perry City	89	30	57.0	2.42	
Phenix	.....	.....	.....	3.26	
Pine City	.....	.....	.....	2.96	
Plattsburg Barracks	84	.....	.....	5.71	
Port Byron	84	37	59.6	2.00	
Port Jervis	85	37	61.2	6.51	
Poughkeepsie	86	33	60.9	4.99	
Primrose	86	35	61.9	5.70	
Richmondville	.....	.....	.....	3.22	
Ridgeway	87	39	59.6	4.07	
Rome	87	34	59.6	2.00	
Romulus	88	39	60.2	3.08	
Rose	.....	.....	.....	2.80	
St. Johnsville	89	31	60.0	3.94	
Salisbury Mills	.....	38	.....	6.00	
Saranac Lake	86	26	54.6	2.60	T.
Saratoga Springs	81	37	58.9	8.82	
Schenectady	89	37	61.8	11.21	
Schenevus	.....	.....	.....	3.85	T.
Scottsville	.....	.....	.....	2.89	
Setauket	83	45	63.8	5.02	
Sherwood	.....	.....	.....	2.44	
Skaneateles	.....	.....	.....	3.29	
South Canisteo	87	30	56.0	3.15	T.
Southeast Reservoir	.....	.....	.....	7.10	
South Kortright	84	32	56.9	4.89	
Straits Corners	.....	.....	.....	2.18	T.
Volusia	86	32[j]	58.0[s]	8.27	1.0
Wappingers Falls	84	39	62.4	9.70	
Warwick	.....	.....	.....	7.18	
Watertown	86	31	59.2	3.09	T.
Waverly	90	30	59.0	2.40	
Wedgwood	89	35	58.8	2.48	
West Berne	.....	.....	.....	4.49	T.
West Chazy	81	31	55.4	.....	
Westfield *a*	88	36	60.2	7.02	
Westfield *c*	85	42	62.3	7.20	
Westpoint	82	35	58.4	6.39	
Willetspoint	82	44	66.2	4.50	
Williamson	.....	.....	.....	3.04	T.
North Carolina.					
Ashers	97	30	67.8	6.27	
Asheville	.....	.....	.....	1.98	
Biltmore	92	34	65.0	1.75	
Bryson City	.....	.....	.....	2.89	
Chapelhill	102	42	71.6	2.47	
Currituck	.....	.....	.....	0.49	
Durham	98	.....	.....	3.20	
Edenton	98	43	71.5	0.30	
Experimental Farm	.....	.....	.....	3.63	
Fairbluff	.....	.....	.....	2.89	
Fayetteville	90	43	71.6	5.29	
Flatrock	88	31	62.3	1.84	
Goldsboro	96	44	70.7	3.31	
Greensboro	95	44	69.5	1.76	
Henderson	101	43	69.7	4.49	
Hendersonville	91	33	65.0	2.26	
Horse Cove	89	33	64.9	1.17	
Kinston	99	40	71.6	2.51	
Lenoir[*1]	89	40	65.9	3.15	
Linville	80	39	57.4	4.41	
Littleton	103	42	69.4	2 92	
Louisburg	99	41	69.6	7.86	
Lumberton	95	45	72.4	3.08	
Mana	.....	.....	.....	2.11	
Marion	95	36	68.6	4.41	
Marshall	92	31	64 5	2.34	
Mocksville	97	42	71.4	3.30	
Moncure	98	41	71.1	5.41	
Monroe	99	34	68.5	3.09	
Morganton	97[s]	39[s]	71.6[s]	2.47	
Mountairy	94	35	66.0	4.37	
Mount Pleasant	98	38	71.0	1.76	
Murphy	.....	.....	.....	2.34	
Newbern	98	42	73.6	1.17	
Oakridge	99	38	68.6	2.48	
Pantego	.....	.....	.....	T.	
Patterson[*1]	92	36	62.4	2.83	
Pittsboro	101	37	69.9	3.71	
Rockingham	99	41	71.8	5.82	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
North Carolina—Cont'd.	°	°	°	*Ins.*	*In s.*
Roxboro	99	38	66.9	2.16	
Salem	99	38	69.0	1.87	
Salisbury	100	42	71.2	1.53	
Saxon	99	34	68.3	4.08	
Selma	102	40	71.0	3.40	
Settle	99	35	67.5	2.18	
Sloan	96	41	72.6	0.70	
Soapstone Mount	100	33	68.3	2.67	
Southern Pines *a*	103	45	73.3	4.84	
Southern Pines *b*	94	45	71.5	4.34	
Southport	91	50	75.2	0.55	
Springhope[*1]	95	42	67.1	3.10	
Tarboro	105[s]	38[s]	72.8[s]	2.53	
Waynesville	87	29	61.2	2.60	
Weldon *a*	96	43	69.3	3 82	
Weldon *b*	.....	.....	.....	3.84	
North Dakota.					
Amenia	87	21	55.6	1.71	
Ashley	91	13	53.8	0.43	
Berlin	90	15	53.8	0.40	T.
Buxton	87	19	53.6	0.63	2.0
Churchs Ferry	91	17	54 3	0.26	
Coalharbor	96	24	57.6	0.37	
Devils Lake	90	25	54.4	0.18	
Dickinson	96	24	57.4	0.08	
Donnybrook	80	.....	.....	0.70	
Ellendale	91	18	56.2	0.02	
Fargo	92	17	55.2	1.24	.....
Forman	90	11	55.0	0.81	
Fort Berthold	93	28	58.9	1.08	
Fort Yates	101	15	60.8	0.00	
Fullerton[1]	90[s]	16	53.6	0.94	
Gallatin	92	11	53.6	0.49	
Glenullin	92	19	56.8	0.32	
Hamilton	88	18	53.0	0.98	0.5
Hannaford	92	19	54.7	0.45	T.
Langdon	85	20	51.0	1.62	
Larimore	90	19	53.7	0.22	
Lisbon	91	19	55.1	1.38	T.
McKinney	86	19	53.7	0.80	
Mayville	94	23	57.3	0.36	1.2
Medora	99	22	59.4	0.31	T.
Melville	92	20	58.5	0.20	T.
Milton	83	20	51.0	.....	
Minnewaukon	90	16	54.0	0.32	
Minot	90	27	55.9	0.80	
Minto	88	14	54.0	0.96	
Napoleon	93	20	55.2	0.66	T.
Oakdale	88[3]	30[1]	56.4[4]	0.52	
Pembina	87	18	52.8	0.90	
Power	89	14	54.8	0.72	
St. John	79	24	52.4	0.35	
Sheyenne[1]	86	18	54.2	0.56	
Towner	90	18	52.2	0.56	T.
University	85	22	54.9	.....	
Wahpeton	90	19	56.4	1.76	
Willow City	89	18	54.4	0.63	
Woodbridge	82	15	51.4	0.61	
Ohio.					
Akron	93	32	62.5	3.55	
Ashland	96	30	63.9	3.13	
Ashtabula	91	39	61.3	4.30	
Atwater	.....	.....	.....	3.82	
Bangorville	98	27	63.0	3.24	
Bellefontaine	96	30	63.6	1.23	
Bement	.....	.....	.....	2.18	T.
Benton Ridge	97	29	63.6	0.96	T.
Bethany	102	30	67.6	1.94	
Bigprairie	94	34	64.1	3.48	
Binola	.....	.....	.....	3.57	T.
Bloomingburg	96	32	65.8	2.45	
Bowling Green	96	29	62.6	2.01	
Bucyrus	96	28	62.0	3.88	
Cambridge	95	29	61.4	2.60	
Camp Dennison	101	30	67.2	2.24	
Canal Dover	94	34	63.2	3.61	
Canton	92	33	64.4	3.26	T.
Cedarville	.....	.....	.....	1.22	
Chillicothe	99	34	67.2	2.15	
Circleville	98	32	67.1	2.74	
Clarksville	99	29	66.6	1.21	
Cleveland *a*	89	40	62.1	2.67	T.
Cleveland *b*	92	38	61.3	2.38	T.
Clifton	103	38	64.8	1.11	
Coalton	102	31	66.3	2.75	
Colebrook	92	32	61.2	3.48	T.
Dayton *a*	102	30	67.2	1.22	
Dayton *b*	.....	.....	.....	1.17	
Defiance	94	32	62.6	3.71	
Delaware	101	28	64.4	1.85	
Demos	93	32	63.4	3.36	
Dupont	92	24	60.6	2.80	
Elyria	96	35	61.7	3.14	
Findlay	99	30	65.0	1.61	
Frankfort	95	32	64.3	1.99	
Garrettsville	94	31	61.1	3.03	T.

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Ohio—Cont'd.	°	°	°	*Ins.*	*Ins.*
Granville	98	31	66.0	2.62	
Gratiot	94	32	63.8	2.59	
Greenfield	96	36	67.3	0.60	
Greenhill	93	29	61.1	3.43	T.
Greenspring [f]	94	35	71.6	1.53	
Greenville	90	32	63.8	2.67	
Hanging Rock	102	31	68.4	3.61	
Hillhouse	94	32	60.7	5.58	T.
Hillsboro	90	30	65.3	2.60	
Hiram	92	33	62.0	3.40	T.
Hudson	98	32	62.4	3.07	
Kenton	100	29	66.0	1.32	
Killbuck	95	36	64.1	3.23	
Lancaster	98	33	65.2	1.98	
Leipsic	94	26	60.9	1.50	
Lordstown	96	32	61.2	3.87	
McArthur	101	32	64.2	3.47	
McConnelsville	98	32	65.0	5.85	
Mansfield	.....	.....	.....	4.55	
Marietta	94	38	66.5	4.76	
Marion	100	30	65.4	1.39	
Medina	96	32	63.3	3.68	T.
Milfordton	99	30	62.2	2.54	
Milligan	101	30	64.9	4.37	
Millport	91	33	61.6	3.49	T.
Montpelier	92	29	60.6	2.47	T.
Napoleon	93	26	60.0	3.60	
Neapolis	.....	.....	.....	3.90	
New Alexandria	90	35	63.2	3.65	
New Berlin	97	32	63.6	3.26	
New Holland	100	32	65.4	1.81	
New Paris	99	29	66.6	1.27	
New Richmond	103	30	68.5	1.50	
New Waterford	89	34	61.7	4.09	
North Lewisburg	98	32	64.0	2.10	
North Royalton	97	32	62.6	3.68	
Norwalk	98	30	60.9	1.33	
Oberlin	98	30	62.6	2.57	T.
Ohio State University	99	31	65.0	1.38	
Orangeville	91	29	60.4	2.47	T.
Ottawa	98	29	64.0	1.86	
Pataskala	97	30	64.6	2.43	
Philo	96	29	63.8	4.37	
Plattsburg	99	29	66.2	1.37	
Pomeroy	99[d]	34	67.1	3.74	
Portsmouth *a*	.....	.....	.....	3.28	
Portsmouth *b*	101	35	67.8	3.28	
Pulse	.....	.....	.....	2.25	
Richwood	101	30	66.1	1.31	
Ridgeville Corners	94	29	63.3	2.63	
Ripley	100	29	66.0	2.66	
Rittman	92	30	61.6	4.66	
Rockyridge	98	29	63.3	2.20	
Rosewood	96	32	63.8	1.58	
Seaman	98	29	66.1	2.63	
Shenandoah	97	29	62.8	4.09	
Sidney	102	32	66.5	1.26	
Sinking Spring	98	35	67.0	2.65	
Somerset	97	35	67.3	2.80	
Springboro	.....	.....	.....	1.57	
Strongsville	.....	.....	.....	3.14	
Thurman	104	32	69.7	3.75	
Tiffin	95	32	63.0	1.53	
Upper Sandusky	96	30	64.4	1.30	
Urbana	95	33	64.4	1.83	
Vanceburg	100	31	65.2	2.55	
Vanwert	98	30	64.2	2.35	
Vermillion	95	32	62.3	2.33	T.
Vickery	97	31	62.7	0.85	
Walnut	.....	.....	.....	2.26	
Warren	93	33	62.0	3.44	T.
Warsaw	100	29	63.4	3.58	
Wauseon	94	29	61.9	2.70	
Waverly	103	32	67.5	3.00	
Waynesville	98	31	64.8	1.04	
Wellington	96	31	63.7	2.35	
Westerville	.....	.....	.....	1.90	
Wooster	94	32	61.7	5.56	
Youngstown	.....	.....	.....	3.31	
Zanesville	.....	.....	.....	3.26	
Oklahoma.					
Arapaho	101	41	73.0	4.44	
Beaver	101	39	70.2	3.78	
Burnett	101	34	71.8	2.51	
Fort Reno	102	43	73.8	1.65	
Fort Sill	99	46	76.2	0.80	
Guthrie	100	44	73.2	1.18	
Hennessey	.....	.....	.....	2.64	
Hopeton	99	38	71.9	2.82	
Kingfisher	101	43	73.9	1.38	
Mangum	97	42	71.5	6.91	
Newkirk	100	40	71.2	1.20	
Pawhuska	101	32	67.0	2.31	
Perry	102	41	73.9	1.41	
Prudence	103	35	72.6	2.60	
Sac and Fox Agency	103	32	72.8	0.93	
Oklahoma—Cont'd.					
Stillwater	100	37	73.8	0.88	
Waukomis	102	37	72.0	2.28	
Winnview	101	40	74.2	2.35	
Woodward	103	40	74.8	4.00	
Oregon.					
Albany *b*	.....	.....	.....	1.30	
Alpha	92	40	63.4	2.95	
Arlington	94	45	66.8	0.49	
Ashland *b*	96	36	64.6	0.32	
Aurora [*1]	88	48	63.2	1.80	
Aurora (near)	85	41	60.1	2.15	
Bandon	68	46	56.0	1.71	
Bay City	79	42	56.8	2.87	
Blalock	97	49	70.5	0.25	
Brownsville [*1]	90	45	60.6	1.25	
Bullrun	82	44	59.9	2.77	
Burns (near) [e]	91	28	60.4	0.00	
Cascade Locks	86	45	63.4	2.69	
Comstock [*1]	90	44	60.8	1.58	
Coquille	.....	.....	.....	1.58	
Corvallis	89	41	62.3	1.04	
Dayville	93	35	61.8	0.32	
Ella	.....	.....	.....	0.41	
Eugene	88	43	61.6	1.39	
Fairview	88	43	62.8	2.08	
Falls City	85	43	60.2	2.64	
Gardiner	80	47	60.2	2.31	
Glenora	95	38	62.4	3.02	
Government Camp	90	31	56.0	3.20	
Grants Pass	96	38	64.4	0.59	
Happy Valley	89	23	56.1	0.05	
Heppner	94	39	63.2	1.66	
Hood River (near)	94	40	62.8	0.68	
Jacksonville	99	37	67.0	0.54	
Joseph	90	32	59.0	0.37	
Junction City [*1]	97	48	63.4	1.30	
Kerby	93	35	62.2	1.11	
Klamath Falls	94	36	65.6	0.10	
Lafayette [*1]	90	48	61.6	1.58	
Lagrande	93	35	62.2	0.48	
Lakeview	88	28	59.2	0.00	
Langlois	84	34	61.4	3.87	
Lonerock	94	29	56.6	1.02	
McMinnville [1]	85*	40	61.0	2.56	
Merlin [*1]	101	44	65.4	0.61	
Monmouth *a* [*1]	89	49	66.8	1.27	
Monroe	89	45	62.8	1.69	
Mount Angel	92	40	65.0	0.82	
Nehalem	.....	.....	.....	4.63	
Newberg	92	41	62.1	2.06	
Newbridge	93	31	60.2	0.07	
Newport	82	42	55.4	2.94	
Pendleton	100	40	66.2	1.84	
Placer	.....	.....	.....	1.11	
Prineville	93	31	61.2	T.	
Riddles [*1]	96	50	64.8	0.66	
Riverside	.....	.....	.....	T.	
Salem *b*	86	40	61.9	1.35	
Sheridan [*1]	94	43	62.5	1.52	
Silver Lake	93	23	56.1	0.37	
Silverton [*1]	88	50	63.2	1.89	
Siskiyou [*1]	93	50	69.7	0.50	
Sparta	89	33	61.5	T.	
Springfield [*1]	85	45	59.7	0.64	
Stafford	94	45	63.8	2.07	
The Dalles	93	42	65.6	0.81	
Tillamook Rock	.....	.....	.....	2.79	
Toledo	91	40	59.4	2.60	
Umatilla	.....	.....	.....	0.38	
Vale	91	32	60.6	0.15	
Vernonia	106	40	65.0	2.10	
Westfork [*1]	85	38	59.8	0.62	
Weston	90	38	62.6	1.79	
Williams	92	35	62.0	0.70	
Pennsylvania.					
Altoona	89	33	60.4	3.82	
Aqueduct	92	39	65.0	3.92	
Athens	90	32	59.8	2.49	
Beaver Dam	.....	.....	.....	3.36	
Bethlehem	.....	.....	.....	7.31	
Brookville	.....	.....	.....	4.92	
Browers Lock	.....	.....	.....	6.30	
Butler	89	33	60.3	2.20	
Carlisle	.....	.....	.....	4.05	
Cassandra	83	37	59.3	3.70	
Cedarrun	.....	.....	.....	2.15	
Centerhall	85	34	61.4	3.90	T.
Chambersburg	89	35[d]	62.0	4.88	
Coatesville	93	35	65.2	5.70	
Confluence	91	30	61.8	5.68	
Coopersburg	83	41	63.2	7.25	
Davis Island Dam	.....	.....	.....	2.90	
Derry Station	93	36	65.8	2.95	
Doylestown	.....	.....	.....	7.30	
Driftwood	.....	.....	.....	3.26	
Duncannon	.....	.....	.....	4.07	
Pennsylvania—Cont'd.					
Dushore	.....	.....	.....	2.80	T.
Dyberry	83	31	57.9	4.90	
East Bloomsburg	.....	.....	.....	3.62	
East Mauch Chunk	86	34	61.8	6.05	
Easton	83	40	63.6	6.14	
Ellwood Junction	.....	.....	.....	2.61	
Emporium	86	33	59.2	4.89	T.
Ephrata	92	38	65.3	7.26	
Everett	90	32	61.4	4.70	
Farrandsville	.....	.....	.....	4.33	
Forks of Neshaminy [*1]	84[d]	42[d]	61.5[d]	6.65	
Franklin	90	23	61.6	2.98	T.
Frederick	.....	.....	.....	5.61	
Freeport	.....	.....	.....	2.09	
Girardville	.....	.....	.....	6.65	
Grampian	82	32	58.8	3.00	T.
Greensboro	91	35	64.1	8.30	
Hamburg	89	38	64.2	6.90	
Hawley	84	31	58.4	3.86	
Hawthorn	89	29	61.0	3.76	T.
Hews Island Dam	.....	.....	.....	2.27	
Huntingdon *a*	91	33	59.7	3.65	T.
Huntingdon *b*	.....	.....	.....	3.57	
Irwin	.....	.....	.....	2.41	
Johnstown	92	35	63.4	3.45	
Keating	.....	.....	.....	4.53	
Kennett Square	90	38	65.3	4.55	
Lansdale	.....	.....	.....	6.96	
Lawrenceville	90	30	59.4	3.03	
Lebanon	88	36	63.4	6.20	
Leroy	86	33	58.4	2.85	T.
Lewisburg	89	35	62.1	4.36	
Lockhaven *a*	91	36	63.6	3.63	
Lockhaven *b*	.....	.....	.....	3.57	
Lock No. 4	.....	.....	.....	4.92	
Lycippus	89	35	64.4	3.63	
Mifflin	.....	.....	.....	3.45	
Nisbet	.....	.....	.....	3.92	
Oil City	.....	.....	.....	4.47	
Ottsville	.....	.....	.....	5.13	
Parker	.....	.....	.....	4.18	
Philadelphia	89	45	67.2	3.94	
Quakertown	88	36	62.9	8.16	
Reading [2]	.....	.....	62.1	4.79	
Renovo *a*	.....	.....	.....	4.00	
Renovo *b*	89	35	61.2	4.61	T.
Ridgway	.....	.....	.....	3.46	
Saegerstown	91	27	60.6	5.25	T.
St. Marys	85	30	58.2	4.96	
Salem Corners	84	34	60.1	4.48	
Scranton	87	33	61.5	3.47	
Seisholtzville	.....	.....	.....	9.31	
Selinsgrove *a*	87	36	62.2	4.72	
Shawmont	.....	.....	.....	4.12	
Shinglehouse	88	.....	.....	3.13	T.
Sinnamahoning	.....	.....	.....	1.31	
Smiths Corners	.....	.....	.....	7.72	
Somerset	92	30	58.3	7.18	
South Eaton	86	34	60.6	2.16	
State College	88	32	60.6	3.84	T.
Sunbury	.....	.....	.....	4.95	
Swarthmore	87	31	64.0	3.95	
Swiftwater	.....	.....	.....	7.30	
Towanda	88	32	59.5	2.03	
Troutrun	.....	.....	.....	3.03	
Uniontown	88	38	63.0	8.17	
Warren	84	33	60.6	7.19	0.2
Wellsboro	88	30	58.8	2.97	T.
Westchester	88	42	65.0	6.55	
West Newton	.....	.....	.....	3.38	
Wilkesbarre	87	30	61.8	4.29	
Williamsport	88	32	61.8	2.94	
York	89	35	63.4	6.07	
Rhode Island.					
Kingston	82	36	60.4	7.26	
Lonsdale	.....	.....	.....	8.97	
Pawtucket	81	43	62.0	8.98	
Providence *a*	82	44	63.2	9.16	
Providence *c*	81	42	61.6	9.45	
South Carolina.					
Allendale	96	51	75.2	0.95	
Batesburg	95	45	72.8	4.18	
Beaufort	94	54	78.2	1.48	
Blackville	98	44	74.8	2.51	
Calhoun Falls	.....	.....	.....	3.11	
Camden	.....	.....	.....	3.34	
Cheraw *a*	101	41	73.9	2.38	
Cheraw *b*	.....	.....	.....	2.29	
Clemson College	100	38	70.6	1.44	
Conway	.....	.....	.....	4.88	
Darlington	.....	.....	.....	3.34	
Edisto	.....	.....	.....	1.97	
Effingham	.....	.....	.....	1.76	
Florence	94	46	72.9	2.30	
Gaffney	.....	.....	.....	1.80	
Georgetown	96	51	74.4	2.25	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
South Carolina—Cont'd.	°	°	°	*Ins.*	*Ins.*
Gillisonville	96	46	74.6	0.88	
Greenville	95	43	69.4	2.30	
Greenwood	93	44	71.2	3.80	
Holland	94	35	67.9	2.87	
Kingstree *a*	93	45	72.9	2.97	
Kingstree *b*	.....	.....	.....	3.05	
Little Mountain	99	45	73.0	3.81	
Longshore	97	42	71.8	3.08	
Pinopolis *1	91	52	72.7	1.95	
St. Georges	95	47	74.0	3.44	
St. Matthews	99	48	74.1	1.88	
St. Stephens	.....	.....	.....	2.32	
Santuck	97	39	70.8	2.98	
Shaws Fork	99	38	72.6	2.13	
Smiths Mills	.....	.....	.....	5.25	
Societyhill	93	43	72.0	2.78	
Spartanburg	97	40	69.9	3.54	
Statesburg	95	48	73.7	2.24	
Summerville	94	48	73.0	3.12	
Temperance	93	42	73.9	3.05	
Trenton	94	48	74.1	1.77	
Trial	94	42	69.9	2.54	
Walhalla	93	34	67.5	1.05	
Winnsboro	91	47	69.8	2.24	
Yemassee	98	48	75.8	1.19	
Yorkville	102	46	73.2	4.35	
South Dakota.					
Aberdeen	92	18	58.1	1.00	
Alexandria	92	15	60.1	T.	
Armour	90	17	61.6	0.06	
Ashcroft	100	22	60.1	0.43	
Bowdle	93	15	55.0	0.85	
Brookings	92	12	56.7	0.17	
Canton	95	15	58.3	0.00	
Centerville	.....	.....	.....	0.33	
Chamberlain	98	23	63.9	0.12	
Chandler	98	17	62.4	0.14	
Clark	.....	.....	.....	0.58	
Desmet	87	16	56.0	0.32	
Doland	90	11	57.4	0.62	
Elkpoint	99	23[c]	61.4[c]	0.20	
Farmingdale	.....	.....	.....	0.58	
Flandreau	95	15	59.9	0.35	
Forestburg	97	16	58.4	T.	
Forest City	104	23	59.8	0.50	
Fort Meade	100	28	62.0	1.10	
Gannvalley	95	21	60.8	T.	
Goudyville	95	15	57.4	1.60	
Highmore	91	33	62.8	0.48	
Hitchcock	.....	.....	.....	0.45	
Hotch City	.....	.....	.....	0.30	
Hot Springs	96	28	59.2	0.50	
Howard	90	13	58.4	0.10	
Interior	102	38	68.2	0.50	
Ipswich	90	15	56.6	1.21	
Kimball	96	28	62.4	0.24	
Leola	83[c]	17[b]	54.8[c]	0.04	
Leslie	108	28	62.1	0.80	
Mellette	91	16	56.8	1.26	
Menno	93	16	60.8	0.12	
Millbank	88	15	57.2	0.42	
Mitchell	96	11	59.2	0.03	
Montrose	92	21	60.4	0.07	
Parker	92	17	59.1	T.	
Plankinton	94	16	59.6	0.10	
Redfield	91	16	57.4	1.27	
St. Lawrence	97	12	59.0	0.25	
Shiloh	105	24	54.8	0.85	
Silver City	.....	.....	.....	1.06	
Sioux Falls	94	13	57.8	0.21	
Spearfish	97	34	62.6	2.05	
Tyndall	90	21	62.4	T.	
Watertown	86	9	53.0	0.45	
Waubay	86	17	56.0	1.69	
Wentworth	89	18	57.0	0.19	
Wessington Springs [c]	91	18	56.0	0.15	
Wolsey	.....	.....	.....	0.42	
Tennessee.					
Andersonville	98	35	68.0	3.01	
Arlington	96	33	69.1	0.33	
Ashwood	99	35	71.0	1.09	
Benton	101	31	69.4	0.59	
Bluff City	.....	.....	.....	4.53	
Bolivar	100	34	69.9	0.95	
Bristol	92	32	64.3	2.93	
Brownsville	99	39	71.8	0.67	
Byrdstown	96	32	68.4	3.43	
Carthage	99	37	70.4	1.56	
Clinton	.....	.....	.....	1.08	
Covington	100	41	73.8	0.58	
Decatur	97	34	68.6	2.65	
Dover	104	29	68.4	0.78	
Dyersburg	99	38	71.4	1.10	
Elizabethton	98	30	66.9	3.07	
Elk Valley	.....	28	.....	0.93	
Erasmus	95	.....	.....	1.57	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Tennessee—Cont'd.	°	°	°	*Ins.*	*Ins.*
Florence	95	35	69.1	1.40	
Franklin	104	34	71.6	0.81	
Grace *1	100	46	68.4	0.80	
Greeneville	95	31	66.4	5.00	
Harriman	98	36	69.2	1.23	
Hohenwald	97	28	67.2	0.91	
Johnsonville	102	31	69.4	1.39	
Jonesboro *1	91	39	65.1	3.90	
Kingston	.....	.....	.....	1.47	
Lafayette *5	95	33	68.6	0.66	
Lewisburg	100	34	70.6	0.64	
Liberty	98	32	69.1	2.21	
Lynnville	96	37	71.4	0.53	
McMinnville	95	33	68.0	0.85	
Madison	100	32	70.0	1.42	
Maryville *5	101	37	70.6	1.61	
Milan	102	35	72.2	0.43	
Newport	98	34	68.2	3.83	
Nunnelly	99	29	67.4	1.46	
Oakhill	98	33	68.2	3.53	
Palmetto	102	33	71.5	1.26	
Peryear *5	101	32	73.0	0.75	
Pope	105	28	69.8	2.25	
Rogersville	95	33	66.5	2.45	
Rugby	95	29	65.4	0.62	
Savannah	101	33	70.7	2.62	
Sewanee	93	34	68.4	0.23	
Silverlake	85	32	60.7	3.74	
Springdale	104	29	69.6	2.86	
Springfield	101	30	69.3	0.60	
Sylvia	99	31	70.4	1.03	
Tazewell	.....	.....	.....	3.08	
Tellico Plains	99	31	69.6	1.78	
Tracy City	90	30	64.8	0.72	
Trenton	103	30	71.8	0.47	
Tullahoma	97	27	68.0	0.75	
Union City	99	33	69.6	1.00	
Waynesboro	98	29	68.5	0.40	
Wildersville	95	34	69.5	0.38	
Yukon	98	38	71.0	0.32	
Texas.					
Alvin	.....	.....	.....	3.57	
Anna	105	42	76.6	1.24	
Arthur	.....	.....	.....	0.00	
Austin *a*	96	48	76.0	1.60	
Austin *b* *5	98	48	77.1	.....	
Ballinger	97	48	74.4	0.31	
Beaumont	96	50	77.2	1.32	
Beeville	102	49	78.5	2.75	
Bianco [g]	100	54	80.1	2.35	
Boerne *1	95	53	75.6	2.97	
Brazoria	93	51	76.0	2.23	
Brenham	99	52	78.0	0.66	
Brighton	.....	.....	.....	2.04	
Brownwood	.....	.....	.....	3.00	
Burnet *1	94	50	75.6	1.13	
Camp Eagle Pass	.....	44	.....	6.50	
Coleman	100	54	76.0	0.42	
College Station	96	52	75.8	0.00	
Colorado	.....	.....	.....	1.58	
Columbia	92	49	75.2	2.37	
Conroe	95	50	76.3	0.78	
Corsicana	102	.....	.....	0.79	
Cuero	99	51	78.9	3.14	
Dallas	102	44	75.2	1.88	
Danevang	98	48	77.8	3.77	
Dublin	102	51	75.5	1.48	
Duval	98	55	78.0	0.82	
Emory	103	44	77.0	0.63	
Estelle	103	49	76.9	2.45	
Forestburg	.....	.....	.....	1.50	
Fort Brown	97	60	80.2	2.70	
Fort Clark	98	58	80.4	0.00	
Fort McIntosh	102	57	80.8	1.88	
Fort Ringgold	100	57[b]	81.8[d]	0.60	
Fredericksburg *1	98[c]	51[c]	76.6[c]	1.41	
Fruitland	101	52	76.6	0.87	
Gainesville	102	46	76.0	2.40	
Georgetown *5	100	50	77.6	2.22	
Grapevine	102	50	76.8	1.29	
Hale Center	97	49	72.6	1.35	
Hallettsville	95	48	77.3	4.33	
Hearne	98	49	77.4	0.00	
Henrietta	103	46	76.5	1.80	
Hewitt	.....	.....	.....	0.80	
Hondo	.....	.....	.....	2.06	
Houston	92	54	76.4	4.24	
Hulen	98	49	78.0	3.36	
Huntsville	99	49	76.3	2.48	
Jacksonville	98	40	74.8	0.36	
Jasper	97	48	75.8	0.55	
Kent	.....	.....	.....	0.83	
Kerrville	102	43	74.0	1.95	
Lampasas	99	45	76.4	0.45	
Langtry	97	57[d]	78.6	1.63	
Lapara	.....	.....	.....	2.90	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Texas—Cont'd	°	°	°	*Ins.*	*Ins.*
Laureles Ranch	.....	.....	.....	4.10	
Llano *5	97	57	77.9	2.06	
Longview	105	41	76.4	0.43	
Luling	98	50	78.2	1.65	
Mann	98	48	76.2	2.02	
Marathon	94	44	67.8	3.43	
Monahans	.....	.....	.....	1.41	
Mount Blanco	98	40	71.7	1.12	
New Braunfels	97	48	76.5	1.17	
Panter	.....	.....	.....	1.57	
Paris *a*	106	47	77.0	0.57	
Paris *b* *1	103	54	78.9	.....	
Point Isabel *1	92	74	82.1	1.50	
Rhineland	102	49	76.2	1.23	
Rockisland	98	51	77.6	2.78	
Rockport *1	90	65	80.9	.....	
Runge	100	52	79.8	0.51	
Sabine	99	52	77.9	4.25	
San Antonio	98	54	79.8	0.31	
Sanderson	.....	64	.....	1.35	
San Marcos	98	46	76.2	0.94	
Sugarland	102	47	79.4	2.00	
Sulphur Springs	101	48	76.2	1.14	
Temple *a*	99	54	77.4	0.70	
Temple *b*	100	50	75.5	0.65	
Tyler	98	47	76.2	0.00	
Valentine	94	.....	.....	T.	
Waco	99	50	77.2	1.10	
Waxahachie	102	44	75.8	1.25	
Weatherford	99	49	76.2	2.70	
Wichita Falls	.....	.....	.....	1.51	
Utah.					
Bluecreek *1	90	45	64.2	T.	
Brigham	.....	.....	.....	0.00	
Castledale	90	40	65.8	0.25	
Cisco	97	43	68.4	0.01	
Corinne	97	39	66.2	0.00	
Croydon	90	27	54.4	0.70	
Deseret	97	33	64.1	T.	
Fillmore [f]	98	36	67.2	0.00	
Fort Duchesne	94	34	63.1	0.00	
Frisco	89	43	68.2	T.	
Giles	99	37	68.2	0.18	
Grover	83	31	58.2	0.24	
Heber	86	28	57.0	0.15	
Huntsville	.....	.....	.....	0.16	
Kelton *1	90	45	65.2	0.00	
Levan	90	36	61.9	0.00	
Loa	89	29	56.8	0.00	
Logan	89	40	65.0	0.02	
Manti	94	38	64.2	T.	
Marysvale	.....	.....	.....	T.	
Millville	.....	.....	.....	0.00	
Minersville	92	39	65.8	T.	
Moab	99	40	69.4	0.03	
Mount Pleasant	99	35	65.9	0.00	
Ogden *a* *1	88	50	70.0	0.00	
Pahreah	97	40	69.5	T.	
Parowan	95	37	65.7	0.08	
Pinto	87	29	59.4	0.00	
Promontory	.....	.....	.....	0.03	
Provo [e]	96	41	66.3	0.00	
Richfield	92	31	61.6	0.07	
St. George	103	40	72.5	0.00	
Scipio	92	29	62.4	0.00	
Snowville	89	33	61.0	0.00	
Soldier Summit	80	35	53.6	0.00	
Terrace	.....	.....	.....	T.	
Tooele	92	45	67.5	0.03	
Tropic	86	33	60.0	T	
Vernal	88	40	62.3	T.	
Woodruff	83	22	53.8	0.00	
Vermont.					
Bennington	83	34	60.6	5.60	
Brattleboro	83	32	59.3	3.47	
Burlington	78	39	60.6	6.38	
Chelsea	79	28	54.2	3.94	
Cornwall	79	32	59.4	6.23	
Derby	82	28	55.2	3.61	
Enosburg Falls	83	26	55.0	3.83	
Hartland	79	31	55.0	4.11	
Jacksonville	82	31	54.7	3.92	
Norwich	81	28	56.6	5.33	
St. Johnsbury	77	28	55.2	3.58	
Vernon *6	84	38	58.2	4.03	
Wells	80	32	57.9	5.61	
Woodstock	78	26	54.4	3.44	
Virginia.					
Alexandria	99	42	68.5	4.92	
Ashland	100	41	67.4	4.48	
Barboursville	97	40	68.3	4.90	
Bedford	97	35	67.0	4.27	
Bigstone Gap	96	32	65.6	3.26	
Birdsnest *1	93	48	69.6	0.45	
Blacksburg	94	32	63.1	3.36	
Buckingham	.....	.....	.....	4.76	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Virginia—Cont'd.	°	°	°	*Ins.*	*Ins.*
Burkes Garden	87	30	59.4	4.63	
Callaville	99	39	67.0	3.26	
Christiansburg	.....	.....	.....	4.01	
Cliftonforge	90	36	63.2	0.31	
Columbia	.....	.....	.....	3.90	
Dale Enterprise	100	31	63.4	4.40	
Doswell	98	37	67.5	4.50	
Dwale	.....	.....	.....	1.83	
Farmville	100	40	69.1	2.98	
Fontella	100	39	69.3	5.04	
Fredericksburg	95	40	67.6	5.36	
Hampton	95	50	72.0	0.36	
Hot Springs	89	22	59.2	4.64	
Lexington	95	36	65.1	4.01	
Manassas	94	41	66.6	4.60	
Marion	96	31	64.3	4.02	
Miller School	.....	38	.....	3.76	
Newport News	95	54	73.8	0.63	
Petersburg	99	42	69.2	4.09	
Quantico	96	41	64.0	.....	
Radford	.....	.....	.....	3.29	
Richmond (near)	96	42	67.4	5.55	
Rockymount	96	32	67.6	4.85	
Salem	95	42	68.4	4.44	
Scottsburg	.....	.....	.....	7.16	
Speers Ferry	.....	.....	.....	4.47	
Spottsville	100	37	68.2	1.45	
Stanardsville	96	38	65.0	5.17	
Staunton	98	34	66.4	3.89	
Stephens City	96	37	66.0	3.53	
Sunbeam	98	37	68.6	1.38	
Tobaccoville [9]	100	38	67.2	4.30	
Warrenton	90	44	67.2	5.22	
Warsaw	98	40	69.8	4.36	
Westbrook Farm	95	45	68.0	.....	
Westpoint	.....	.....	.....	2.66	
Woodstock	97	35	65.0	3.12	
Wytheville	95	33	64.6	3.85	
Washington.					
Aberdeen	84	43	60.5	2.32	
Ashford	.....	.....	.....	2.42	
Bremerton	83	42	60.8	1.00	
Bridgeport	94	38	65.6	....	
Brinnon	74	45	58.4	1.26	
Cedar Lake	.....	.....	.....	2.63	
Cedonia	82	32	55.5	1.75	
Centerville	98	29	60.8	0.75	
Chehalis	87	40	62.0	2.01	
Cheney	.....	.....	.....	0.13	
Clearwater	80	37	58.4	2.94	
Cle Elum	91	27	57.0	0.97	
Colville	90	37	63.8	2.47	
Connell	.....	.....	.....	0.19	
Crescent	92	.....	.....	1.10	
Dayton	92	39	62.2	1.08	
Ellensburg	84	33	58.0	0.40	
Ellensburg (near)	94	36	61.8	0.65	
Fort Simcoe	93	39	65.1	0.34	
Grandmound	86	40	61.2	1.94	
Hooper	98	36	65.0	1.11	
Kennewick	94	38	67.6	0.44	
Lacenter	90	40	61.1	2.32	
Lakeside	85	44	65.6	0.19	
Lind	99[f]	35[f]	65.3[f]	0.44	
Mayfield	85	40	61.6	2.39	
Monte Cristo	84	34	59.2	3.40	
Moxee Valley	97	34	63.0	0.54	
New Whatcom	82	36	57.6	0.72	
Northport	84	30	56.0	1.99	
Olga	77	39	55.6	1.02	
Olympia	84	41	60.2	1.97	
Orcas Island	76	39	58.6	.....	
Pinehill	93	41	63.5	0.89	
Pomeroy	.....	.....	.....	1.32	
Port Townsend	76	44	58.6	0.81	
Pullman	91	38	61.8	1.51	
Ritzville	.....	.....	.....	0.29	
Rosalia	89	33	60.2	1.35	
Sedro	82	36	61.4	0.96	
Silvana	76[f]	38[f]	57.0[f]	0.81	
Snohomish	77	42	59.2	1.25	
Snoqualmie	80	48	63.2	2.39	
Southbend	90	40	61.2	2.91	
Sunnyside	93	42	64.7	0.30	
Twin	88	41	59.4	1.23	
Union	78	41	59.2	1.80	
Usk	84	32	58.6	.....	
Vancouver	83	42	61.0	1.83	
Waterville	90	28	60.2	0.35	
Wenatchee (near)	93	39	63.9	0.22	
West Virginia.					
Beckley [8]	89	29	62.4	1.73	
Beverly	93	30	62.4	4.17	
Bluefield	92	33	63.4	2.28	
Buckhannon *a*	..	.....	.....	3.39	
Buckhannon *b*	93	34	62.2	.....	

Stations	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
West Virginia—Cont'd.	°	°	°	*Ins.*	*Ins.*
Burlington	95	32	64.0	4.41	
Cairo	89	31	58.0	3.75	
Charleston	.....	.....	.....	3.44	
Dayton	96	31	63.2	3.37	
Eastbank	98	32	66.2	2.43	
Elkhorn	94	33	64.7	1.72	
Fairmont	.....	.....	.....	3.68	
Glenville	93	37	63.9	4.25	
Grafton	93	34	63.1	4.74	
Green Sulphur	95	28	64.9	3.62	
Hamlin	98	38	67.4	4.54	
Harpers Ferry	.....	.....	.....	3.97	
Hinton *a*	.....	.....	.....	3.56	
Hinton *b* [8]	97	36	67.3	.....	
Huntington	99	31	66.4	3.05	
Kingwood	92	32	62.7	5.38	
Lanes Bottom	.....	.....	.....	1.65	
Madison	86[h]	34	63.2[g]	3.41[h]	
Marlinton	87	32	60.4	4.01	
Martinsburg	94	37	64.6	3.48	
Morgantown	96	34	65.2	2.26	
New Cumberland	98	37	66.9	3.76	
New Martinsville	98	36	65.8	6.35	
Nuttallburg	94	35	65.0	2.48	
Oceana	97	33	65.2	2.41	
Oldfields	93	32	62.2	3.64	
Parsons	89	33	61.8	3.95	
Philippi *a*	96	34	64.8	4.28	
Philippi *b*	.....	.....	.....	4.29	
Point Pleasant	100	36	68.8	3.45	
Powellton	93	36	65.1	2.70	
Romney	93	36	64.5	3.61	
Rowlesburg	.....	.....	.....	2.85	
Terra Alta	.....	.....	.....	6.13	
Uppertract	96	31	64.7	4.68	
Weston *a*	.....	.....	.....	4.04	
Weston *b*	95	35	65.7	.....	
Wheeling *a*	.....	.....	.....	2.90	
Wheeling *b*	96	40	67.5	2.74	
Wisconsin.					
Amherst	83	15	55.3	0.68	T.
Antigo	86	13	52.6	2.71	0.2
Barron	84	14	55.0	0.65	T.
Bayfield	88	28	56.4	3.10	
Beloit	93	23	61.0	3.20	
Brodhead	97	20	61.1	3.34	
Butternut	84	15	52.0	3.13	1.0
Chilton	92	25	56.8	2.85	
Citypoint	87	25	58.0	2.63	
Delavan [f]	95	32	64.7	2.75	
Dodgeville	94	18	59.6	1.44	
Easton	90	14	57.0	2.02	
Eau Claire	83	22	58.0	3.23	T.
Florence	86	26	51.6	2.92	T.
Fond du Lac	90	22	58.1	2.69	
Grand River Locks	.....	.....	.....	2.66	
Grantsburg	83	16	55.6	1.63	
Hartford	93	27	58.8	2.99	T.
Hartland	92	24	59.8	3.60	T.
Harvey	95	24	59.2	3.49	T.
Hayward	80	16	58.4	2.61	T.
Heafford	.....	.....	.....	2.07	T.
Hillsboro	91	16	59.2	1.92	
Knapp	87	17	54.9	3.42	T.
Koepenick [10]	82	30	57.9	2.10	2.0
Lancaster	92	20	58.0	0.93	
Lincoln	91	29	57.8	2.63	
Madison	88	29	59.8	3.35	
Manitowoc	92	26	57.8	2.35	
Meadow Valley	88	14	56.4	2.81	
Medford	87	11	53.0	2.80	T.
Menasha	.....	.....	.....	2.95	
Neillsville	84	14	55.6	1.65	
New Holstein	91	23	56.0	4.00	
New London	91	19	56.4	2.31	
Oconto	91	23	56.8	1.14	
Osceola	85	20	56.0	1.06	T.
Oshkosh	87	31	58.0	2.02	
Pepin	89	22	57.9	2.32	
Pine River	89	19	56.6	2.60	
Portage	89	23	57.7	2.85	
Port Washington	95	27	58.4	3.75	
Prairie du Chien	95	22	63.3	1.56	
Prentice [10]	82[e]	20[e]	50.0[e]	3.47	0.5
Racine	96	28	62.2	4.25	
Sharon	97	23	59.8	2.10	
Shawano	86	21	54.6	1.60	
Sheboygan	92	28	59.6	2.71	
Spooner	88	19	59.1	.....	
Stevens Point	84	13	55.8	1.90	
Sturgeon Bay Canal [10]	90	28	56.8	.....	
Two Rivers [10]	86	28	56.5	.....	
Valley Junction	86	14	57.0	1.60	T.
Viroqua	89	21	59.2	1.40	T.
Watertown	90	20	57.4	3.01	T.
Waukesha	92	28	59.8	3.18	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Wisconsin—Cont'd.	°	°	°	*Ins.*	*Ins.*
Waupaca	89	18	56.7	2.54	
Wausau	84	18	53.4	2.28	
Westbend	90[d]	23[d]	61.0[d]	3.19	
Westfield	89	20	57.7	2.13	
Whitehall	85	19	57.2	2.94	
Wyoming.					
Alcova	94	24	57.7	1.20	
Basin	97	28	59.0	0.23	
Bedford	88	23	53.1	T.	T.
Bigpiney	77	20	49.8	0.10	
Buffalo	95	28	60.1	0.78	
Burns	85	16	48.8	T.	
Carbon	99	30	59.2	0.91	
Centennial	76	26	51.8	0.70	
Douglas	97	26	60.4	2.44	
Embar	91	33	62.0	.....	
Evanston	82	28	56.0	0.04	
Fort Laramie	102	21	62.4	0.53	
Fort Washakie	87	29	58.8	0.59	
Fort Yellowstone	85	27	54.6	0.90	
Fourbear	84	25	54.5	0.73	
Hyattville	92	30	60.4	0.03	
Laramie	85	26	55.2	0.17	
Lovell	91	23	57.8	0.05	
Lusk	95	23	58.1	0.67	
Rawlins	86	29	57.4	0.99	
Rocksprings	89	20	57.0	0.00	
Sheridan	96	27	61.4	1.10	
Thayne	80	21	51.1	0.03	
Thermopolis	94	28	60.5	.....	
Wheatland	96	30	61.8	0.68	
Mexico.					
Ciudad P. Diaz	96	63	80.2	3.14	
Leon de Aldamas	81	46	65.8	4.56	
Puebla	75	46	62.6	6.01	
Topolobampo [11]	100	73	83.2	3.88	
New Brunswick.					
St. John	66	35	55.6	2.73	
Porto Rico.					
Adjuntas	90[f]	58	74.3[d]	6.42	
Arecibo	96	70	81.3	.....	
Bayamon	95	67	81.2	13.09	
Caguas	89	70	80.7	3.21	
Canovanas	90	72	78.8	8.76	
Cayey	92	64	76.6	7.42	
Cidra	85	62	74.4	4.17	
Coamo	97	65	80.8	.....	
Corozal	94	62	78.8	10.15	
Fajardo	90	70	81.0	6.13	
Guayama	.....	.....	.....	7.62	
Isabela	93	64	79.6	8.39	
Juana Diaz	95	69	81.1	10.05	
La Isolina	90	66	77.2	15.53	
Lajas	88	67	80.4	6.64	
Luquillo	88	72	80.0	14.98	
Manati	96	67	80.5	10.52	
Morovis	86	70	78.3	2.00	
Ponce [b]	90	68	80.9	5.35	
Puerta de Tierra	92	73	81.9	12.66	
San Lorenzo	92	69	79.6	12.55	
Vieques	93	73	81.3	8.25	

Late reports for August, 1899.

Alaska.					
Circle	90	27	57.5	.....	
Coal Harbor	69	42	52.6	4.42	
Holy Cross	70	31	51.4	3.67	
Juneau	71	42	56.4	4.88	
Kenai	66	28	51.9	2.34	
Kodiak	75	41	58.2	2.37	
California.					
Chino	.....	.....	.....	0.00	
Dunnigan [11]	100	62	74.8	0.00	
Fort Bragg	.....	.....	.....	0.00	
Glendora	.....	.....	.....	0.02	
Lakeside	.....	.....	.....	0.00	
Mountainview	.....	.....	.....	0.00	
San Miguel Island	75	42	59.1	0.00	
Stanford University	89	45	63.4	T.	
West Palmdale	.....	.....	.....	T.	
Westpoint	.....	.....	.....	0.13	
Maryland.					
Collegepark	96	52	72.5	.....	
Massachusetts.					
Leicester	89	44	67.4	3.00	
Missouri.					
Eightmile [11]	99	62	77.6	3.64	
Lamonte	.....	.....	.....	4.65	
Palmyra [5]	96	60	78.0	7.10	
Richmond	98	62	78.2	6.32	
St. Charles	100	61	79.4	3.05	
Warrensburg	100	52	78.4	2.48	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
North Carolina.	°	°	°	*Ins*	*Ins*
Abshers	97	57	78.5	2.17	
Oregon.					
Happy Valley	85	28	56.6	1.05	
South Carolina.					
Gillisonville	100	64	81.4	8.79	
Walhalla	95	62	77.6	2.90	
Texas.					
College Station	97	68	84.2	0.01	
Gainesville	107	68	88.0	0.00	
Wichita Falls	...	...	...	0.00	
Washington.					
Sedro	86*	42*	63.0*	5.17	
Mexico.					
Topolobampo *[1]	93	75	85.2	2.94	

EXPLANATION OF SIGNS.

* Extremes of temperature from observed readings of dry thermometer.

A numeral following the name of a station indicates the hours of observation from which the mean temperature was obtained, thus:

[1] Mean of 7 a. m. + 2 p. m. + 9 p. m. + 9 p. m. + 4.
[2] Mean of 8 a. m. + 8 p. m. ÷ 2.
[3] Mean of 7 a. m. + 7 p. m. ÷ 2.
[4] Mean of 6 a. m. + 6 p. m. ÷ 2.
[5] Mean of 7 a. m. + 2 p. m. ÷ 2.
[6] Mean of readings at various hours reduced to true daily mean by special tables.
[7] Mean from hourly readings of thermograph.
[9] Mean of sunrise and noon.
[10] Mean of sunrise, noon, sunset, and midnight.

The absence of a numeral indicates that the mean temperature has been obtained from daily readings of the maximum and minimum thermometers.

An italic letter following the name of a station, as "Livingston *a*," "Livingston *b*," indicates that two or more observers, as the case may be, are reporting from the same station. A small roman letter following the name of a station, or in figure columns, indicates the number of days missing from the record; for instance, "[a]" denotes 14 days missing.

CORRECTION.

Table I, Salt Lake City, Utah, from March to August, 1899, inclusive, the elevation of the instruments should have read as follows: Barometer above sea level, 4,360 feet; thermometers and anemometer above ground, 105 and 110 feet, respectively.

TABLE III.—*Mean temperature for each hour of seventy-fifth meridian time, September*, 1899.

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midn't.	Mean.
Bismarck, N. Dak....	51.5	50.2	48.9	48.0	47.2	46.3	45.4	46.0	49.0	53.1	57.6	61.9	64.7	67.0	69.0	70.4	70.7	70.2	68.5	65.2	60.4	57.6	55.0	52.8	57.4
Boston, Mass	58.5	58.1	57.7	57.2	56.5	56.5	57.5	60.3	62.1	63.8	65.5	66.5	67.6	68.5	67.7	67.0	65.6	64.0	62.7	61.7	60.9	60.2	59.3	58.4	61.8
Buffalo, N. Y.....	58.4	57.8	57.3	57.0	56.5	56.1	56.4	57.4	59.1	60.7	61.9	63.0	63.6	64.1	65.1	65.3	64.7	63.3	61.7	60.8	59.7	59.2	58.6	57.8	60.2
Cedar City, Utah....	64.8	63.7	62.3	61.6	61.0	60.3	59.6	59.0	58.3	62.2	66.3	70.4	73.7	76.5	78.4	79.6	79.8	79.3	78.5	76.9	72.1	69.8	67.9	66.0	68.7
Chicago, Ill.....	61.5	60.7	60.0	59.7	59.1	58.4	58.1	59.0	60.0	60.9	62.1	63.5	64.3	65.2	65.8	65.7	66.1	65.6	64.7	64.3	63.4	62.7	61.7	61.3	62.2
Cincinnati, Ohio....	64.4	63.2	62.5	61.8	60.5	59.7	59.3	60.9	63.4	66.7	69.7	71.7	73.5	75.1	76.1	76.8	76.7	75.0	73.1	71.5	68.8	67.3	65.2	64.0	67.8
Cleveland, Ohio	60.8	60.0	59.3	58.6	57.8	57.4	57.6	58.1	60.3	62.7	64.0	64.4	64.6	65.1	65.6	65.9	65.6	65.4	64.3	63.7	62.4	61.7	60.8	59.9	61.9
Detroit, Mich.....	57.2	56.5	55.9	55.7	55.0	54.6	54.2	55.3	56.9	59.1	60.9	62.7	64.0	65.2	65.6	65.9	66.0	65.6	63.6	61.5	59.8	59.1	58.2	57.1	59.8
Dodge, Kans.....	63.6	62.7	61.5	60.2	59.2	58.6	58.3	57.7	60.3	65.6	70.3	74.0	76.7	78.5	80.2	81.3	81.7	80.9	79.1	74.2	70.7	68.6	66.1	64.7	69.0
Eastport, Me.....	51.7	51.4	51.0	50.8	50.4	50.5	51.4	52.9	55.2	56.3	57.7	58.9	59.3	59.1	59.1	58.6	57.2	55.3	54.5	54.0	53.1	52.8	52.2	51.7	54.4
Galveston, Tex.....	78.0	77.6	77.3	77.0	76.6	76.2	76.0	76.2	76.8	78.4	80.4	81.5	82.5	83.2	83.5	83.6	83.2	82.5	81.5	80.5	79.7	79.3	78.9	78.6	79.5
Havre, Mont.....	54.2	53.2	51.5	49.8	48.6	47.2	46.4	45.1	45.8	49.7	54.7	58.8	63.4	66.5	69.1	70.8	71.5	72.3	71.8	69.3	65.1	61.1	57.7	56.2	58.3
Independence, Cal..	74.5	72.2	70.5	69.4	68.3	66.9	65.7	64.4	62.8	65.4	68.9	73.6	76.0	81.5	84.4	86.5	87.8	87.9	87.6	86.9	82.0	79.7	77.8	76.1	75.7
Kalispell, Mont	51.8	50.0	48.8	47.7	46.8	45.9	45.0	44.8	43.7	46.9	51.3	55.2	58.9	61.3	63.2	64.5	65.4	65.3	65.5	64.2	60.9	56.8	54.2	52.8	54.6
Kansas City, Mo.....	64.6	63.7	62.9	61.8	61.0	59.9	59.2	59.7	62.4	66.2	69.4	72.4	74.5	76.0	77.1	77.9	78.0	77.0	75.5	73.3	69.6	67.8	66.5	65.2	68.4
Key West, Fla.....	81.7	81.3	81.2	81.0	80.9	80.2	81.0	82.7	83.5	84.2	85.1	84.8	85.1	85.7	85.5	85.7	85.1	83.7	82.5	82.6	81.9	81.5	81.5	81.4	82.8
Marquette, Mich	50.9	50.6	50.6	50.6	50.2	49.7	49.2	51.1	52.6	53.9	55.6	55.8	56.5	56.5	56.2	55.8	55.6	54.4	53.5	52.4	50.8	50.2	50.1	50.0	52.6
Memphis, Tenn.....	69.6	68.3	67.1	66.3	65.1	64.3	63.7	65.2	69.0	71.8	74.7	76.6	78.3	79.5	80.8	81.1	80.5	79.4	77.3	75.9	73.9	72.8	71.5	69.9	72.6
Mt. Tamalpais, Cal..	71.6	70.9	70.7	70.5	70.2	70.3	70.1	70.2	69.5	69.7	70.4	71.9	73.2	74.9	76.2	77.2	77.9	77.3	76.1	74.7	73.5	71.6	70.9	71.1	72.5
New Orleans, La.....	74.3	73.2	72.7	72.2	71.8	71.4	71.2	72.4	74.8	77.0	79.1	81.4	81.8	82.9	83.3	83.3	82.4	81.5	80.1	78.8	77.0	75.8	75.0	74.3	77.0
New York, N. Y.....	62.5	61.8	61.3	60.8	60.4	60.1	61.1	62.5	64.5	65.8	67.6	69.3	70.0	70.4	70.7	70.5	69.6	67.8	66.8	66.1	65.2	64.5	63.3	62.4	65.2
Philadelphia, Pa.....	62.6	62.0	61.5	60.7	60.2	59.9	60.8	63.0	65.2	67.8	70.0	71.6	73.0	74.0	74.4	73.7	73.1	70.7	68.6	67.3	65.3	64.3	63.3	62.7	66.5
Pittsburg, Pa.....	61.2	60.6	59.4	58.8	58.7	58.3	58.1	59.6	62.4	65.0	68.0	69.8	71.9	72.2	72.9	72.8	72.8	70.6	68.5	67.2	65.2	63.7	62.4	61.1	65.1
Portland, Oreg.....	63.0	62.0	60.5	58.9	57.7	57.1	56.4	55.7	54.7	54.7	56.2	58.1	61.3	63.6	65.6	67.7	70.1	71.8	72.9	72.5	71.3	69.0	66.5	64.3	63.0
St. Louis, Mo.....	66.8	65.8	64.8	63.7	62.8	62.1	61.5	62.7	64.9	68.2	71.4	74.0	75.8	77.1	77.6	78.3	78.1	77.1	75.2	73.1	71.3	69.9	68.2	66.9	69.9
St. Paul, Minn.....	55.7	54.7	53.8	53.0	52.2	51.5	50.9	51.1	52.0	55.0	57.8	60.5	62.9	64.3	65.9	66.9	67.2	66.8	65.1	62.5	60.7	58.8	57.4	55.9	58.4
Salt Lake City, Utah.	62.9	62.0	60.6	59.5	59.0	58.4	58.3	58.4	56.7	58.9	63.5	69.2	72.2	75.1	76.9	78.2	79.1	78.8	77.9	75.7	71.9	68.9	66.8	65.1	67.2
San Diego, Cal.....	63.8	63.3	62.8	62.5	62.1	61.8	61.5	61.0	60.9	61.0	62.1	64.2	65.9	67.0	68.2	68.7	69.5	69.3	69.1	67.8	66.4	65.3	64.7	64.2	64.7
San Francisco, Cal...	53.8	53.4	53.1	52.9	52.5	52.1	51.6	52.3	51.9	52.4	53.6	55.6	57.9	60.8	62.2	63.6	62.6	62.3	60.9	58.8	57.1	55.8	55.0	54.4	56.1
Santa Fe, N. Mex ...	60.4	59.5	58.1	57.1	56.1	54.8	53.0	52.9	55.6	60.8	63.8	66.0	68.0	69.9	71.1	72.6	73.2	72.8	71.5	68.8	64.4	63.2	62.0	60.9	63.2
Savannah, Ga.....	72.5	71.8	70.9	70.1	69.8	69.1	69.4	71.4	75.1	77.9	80.4	81.9	82.9	83.3	83.2	83.0	82.1	79.6	77.1	76.1	74.8	74.1	73.3	72.7	75.9
Washington, D. C....	61.6	60.5	59.6	59.0	58.1	57.5	58.3	62.2	65.8	68.4	71.0	72.5	73.8	74.3	74.9	75.2	74.3	72.4	69.0	66.5	65.0	63.8	62.8	61.6	66.2
West Indies.																									
Basseterre, St. Kitts.	79.0	78.9	78.4	78.2	78.7	79.8	81.6	82.2	82.9	83.8	85.9	84.7	84.1	83.4	82.8	81.8	80.5	79.9	80.0	80.1	79.7	79.8	79.3	79.0	80.9
Bridgetown, Bar.....	77.1	77.0	77.0	76.9	76.5	78.8	82.2	83.5	84.4	84.6	85.3	85.2	85.1	84.7	83.7	82.4	81.4	80.2	79.1	78.6	78.4	78.2	78.0	77.5	80.7
Cienfuegos, Cuba ...	74.9	74.5	74.1	73.8	73.5	73.5	75.1	78.6	82.0	83.9	85.7	87.0	87.6	87.2	86.2	83.4	81.5	80.3	78.5	77.9	76.8	76.5	75.8	75.6	79.3
Havana, Cuba.....	78.2	77.1	76.5	76.2	75.7	75.5	76.8	79.2	83.3	84.9	85.3	85.7	85.0	84.6	83.9	83.5	82.9	82.5	82.0	81.7	80.6	80.0	79.5	78.8	80.2
Kingston, Jamaica ..	75.1	74.8	74.5	74.4	74.0	73.9	76.0	79.9	83.7	85.9	87.0	86.9	86.1	84.1	82.4	82.2	81.2	80.3	78.7	78.0	76.6	76.0	75.7	75.3	79.3
Port of Spain, Trin..	74.6	74.2	74.1	74.0	73.8	74.9	78.3	82.1	84.6	85.5	85.9	85.8	86.0	85.5	84.9	84.6	82.8	80.5	79.5	79.0	78.0	77.3	76.7	75.6	79.9
P. Principe, Cuba ...	73.9	73.5	72.9	72.3	71.9	71.8	74.3	78.6	81.7	84.6	87.0	88.5	89.7	90.2	88.6	85.6	82.5	80.1	78.5	77.6	76.4	75.7	74.9	74.4	79.4
San Juan, P. R.....	77.1	76.8	76.8	76.5	76.3	76.9	78.3	80.4	82.3	83.3	84.4	83.5	83.4	83.1	82.9	82.2	81.1	80.1	79.6	79.8	78.7	78.3	77.5	77.5	79.9
Santiago de Cuba...	76.5	75.9	75.5	75.0	74.6	74.6	77.1	79.9	84.3	86.5	88.4	89.1	89.2	89.0	87.7	86.2	83.5	81.9	80.8	79.8	78.6	78.2	77.6	76.9	81.1
Santo Domingo, S. D.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Willemstad, Curaçao	80.5	80.1	79.9	80.0	79.8	79.7	81.7	83.3	84.3	84.9	85.8	85.6	86.6	87.1	86.8	85.9	84.3	82.9	82.1	81.8	81.4	81.3	80.9	80.7	82.8

TABLE IV.—*Mean pressure for each hour of seventy-fifth meridian time, September*, 1899.

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midn't.	Mean.
Bismarck, N. Dak....	28.284	.285	.288	.289	.292	.297	.304	.313	.319	.324	.322	.313	.299	.284	.265	.252	.241	.237	.238	.240	.250	.262	.270	.277	.281
Boston, Mass.....	29.912	.906	.905	.908	.913	.925	.929	.936	.940	.932	.923	.911	.901	.894	.889	.889	.894	.896	.907	.914	.917	.916	.916	.916	.912
Buffalo, N. Y.....	29.190	.187	.187	.188	.195	.206	.212	.216	.222	.223	.220	.214	.202	.194	.187	.180	.181	.186	.190	.194	.198	.199	.202	.202	.199
Cedar City, Utah....	24.369	.370	.372	.373	.373	.371	.373	.380	.391	.402	.408	.412	.411	.408	.388	.371	.357	.348	.342	.337	.341	.350	.362	.365	.374
Chicago, Ill.....	29.175	.174	.172	.172	.176	.183	.196	.207	.213	.215	.213	.208	.199	.188	.178	.171	.169	.169	.172	.174	.186	.186	.189	.186	.186
Cincinnati, Ohio	29.396	.396	.391	.392	.401	.410	.424	.429	.437	.439	.434	.422	.405	.391	.374	.370	.370	.371	.373	.377	.396	.401	.407	.407	.401
Cleveland, Ohio	29.208	.208	.207	.208	.213	.222	.231	.238	.243	.245	.242	.236	.226	.217	.209	.205	.204	.205	.208	.214	.223	.222	.223	.221	.220
Detroit, Mich.....	29.246	.245	.242	.239	.242	.247	.259	.270	.278	.283	.281	.278	.264	.253	.244	.237	.233	.234	.238	.246	.254	.257	.259	.262	.253
Dodge, Kans	27.483	.484	.485	.484	.484	.485	.486	.489	.497	.503	.505	.498	.486	.469	.449	.429	.418	.414	.414	.424	.441	.459	.471	.479	.468
Eastport, Me	29.950	.944	.943	.945	.952	.959	.966	.973	.974	.974	.969	.964	.957	.949	.943	.941	.939	.944	.951	.956	.957	.957	.955	.954	.955
Galveston, Tex.....	29.960	.957	.955	.953	.954	.961	.972	.986	.997	.006	.011	.006	.995	.978	.957	.941	.929	.936	.927	.939	.952	.963	.970	.971	.965
Havre, Mont.....	27.401	.402	.404	.409	.410	.412	.415	.420	.427	.430	.430	.426	.424	.413	.402	.393	.385	.379	.382	.381	.388	.397	.401	.401	.405
Independence, Cal..	26.013	.017	.024	.029	.031	.036	.039	.048	.062	.069	.076	.078	.077	.063	.041	.020	.000	.984	.973	.969	.965	.973	.991	.003	.024
Kalispell, Mont	27.015	.017	.019	.019	.020	.023	.028	.033	.046	.055	.058	.062	.056	.045	.036	.025	.015	.007	.998	.995	.997	.002	.011	.017	.025
Kansas City, Mo.....	29.063	.066	.066	.065	.071	.080	.088	.101	.112	.121	.120	.109	.096	.076	.058	.040	.031	.025	.027	.029	.046	.056	.064	.066	.070
Key West, Fla.....	29.947	.937	.930	.927	.930	.938	.952	.956	.972	.979	.977	.968	.952	.933	.915	.908	.908	.910	.915	.928	.945	.953	.955	.953	.941
Marquette, Mich	29.224	.223	.220	.216	.220	.227	.237	.237	.239	.240	.236	.233	.227	.229	.220	.222	.222	.222	.225	.229	.239	.240	.239	.236	.229
Memphis, Tenn.....	29.645	.645	.648	.650	.657	.667	.681	.693	.704	.710	.710	.704	.685	.666	.643	.632	.621	.619	.621	.627	.640	.648	.653	.654	.659
Mt. Tamalpais, Cal.	27.577	.577	.573	.572	.567	.562	.561	.563	.579	.591	.601	.612	.616	.614	.610	.603	.592	.580	.572	.567	.563	.567	.576	.577	.582
New Orleans, La.....	29.975	.971	.969	.966	.972	.983	.994	.001	.015	.021	.018	.004	.991	.976	.955	.943	.935	.938	.945	.950	.970	.980	.987	.986	.977
New York, N. Y.....	29.734	.720	.715	.715	.722	.730	.736	.743	.744	.742	.733	.726	.714	.706	.696	.696	.699	.698	.709	.720	.727	.731	.733	.731	.721
Philadelphia, Pa.....	29.938	.935	.934	.936	.942	.950	.961	.964	.968	.966	.958	.949	.935	.922	.912	.910	.912	.916	.926	.941	.945	.946	.947	.947	.953
Pittsburg, Pa.....	29.149	.145	.142	.142	.145	.156	.166	.171	.176	.178	.173	.165	.155	.142	.134	.127	.126	.130	.137	.145	.156	.158	.159	.160	.154
Portland, Oreg.....	29.903	.908	.915	.920	.921	.920	.922	.924	.928	.938	.943	.946	.946	.941	.931	.921	.909	.896	.887	.881	.878	.880	.890	.899	.914
St. Louis, Mo.....	29.453	.454	.454	.456	.462	.469	.481	.493	.502	.506	.505	.495	.484	.465	.448	.436	.428	.428	.429	.436	.448	.458	.462	.464	.462
St. Paul, Minn.....	29.144	.150	.149	.147	.150	.152	.160	.166	.167	.170	.170	.166	.160	.151	.139	.130	.120	.120	.124	.125	.135	.140	.147	.149	.147
Salt Lake City, Utah.	25.691	.692	.695	.695	.696	.700	.706	.713	.727	.736	.743	.747	.741	.731	.718	.703	.690	.680	.673	.669	.668	.677	.685	.687	.703
San Diego, Cal.....	29.812	.812	.808	.805	.799	.794	.793	.797	.806	.818	.825	.831	.831	.823	.811	.797	.785	.780	.777	.779	.783	.794	.805	.814	.803
San Francisco, Cal...	29.846	.849	.850	.849	.846	.845	.845	.850	.863	.872	.882	.885	.884	.876	.863	.850	.830	.820	.810	.802	.808	.820	.835	.843	.847
Santa Fe, N. Mex ...	23.408	.411	.410	.408	.407	.409	.413	.423	.430	.439	.443	.441	.431	.421	.404	.387	.375	.369	.367	.369	.379	.394	.402	.408	.406
Savannah, Ga.....	29.953	.948	.942	.942	.950	.957	.972	.979	.990	.994	.988	.979	.964	.952	.937	.929	.927	.929	.936	.944	.956	.961	.964	.962	.956
Washington, D. C....	29.941	.937	.932	.933	.939	.949	.960	.967	.972	.973	.968	.956	.941	.926	.916	.909	.909	.911	.917	.932	.942	.949	.950	.949	.941
West Indies.																									
Basseterre, St. Kitts.	29.905	.897	.892	.898	.909	.922	.936	.944	.951	.946	.933	.916	.899	.889	.883	.883	.888	.897	.912	.928	.936	.935	.929	.920	.914
Bridgetown, Bar.....	29.877	.872	.878	.885	.894	.905	.920	.930	.930	.922	.906	.882	.863	.855	.854	.857	.865	.877	.891	.907	.912	.909	.904	.893	.891
Cienfuegos, Cuba...	29.861	.849	.840	.839	.847	.860	.872	.883	.892	.891	.885	.873	.850	.829	.816	.818	.826	.841	.856	.868	.884	.886	.881	.875	.859
Havana, Cuba.....	29.883	.871	.864	.861	.869	.881	.892	.899	.911	.914	.912	.896	.883	.866	.856	.853	.852	.858	.867	.879	.896	.903	.901	.895	.882
Kingston, Jamaica..	29.615	.600	.592	.592	.600	.609	.623	.626	.637	.631	.615	.594	.572	.561	.560	.558	.558	.574	.593	.605	.628	.636	.636	.633	.602
Port of Spain, Trin..	29.851	.844	.844	.852	.862	.877	.897	.906	.908	.900	.878	.855	.831	.817	.809	.808	.818	.830	.848	.866	.878	.881	.875	.863	.858
P. Principe, Cuba ...	29.561	.548	.541	.541	.545	.557	.567	.575	.581	.584	.578	.561	.543	.521	.506	.503	.519	.538	.552	.565	.579	.583	.580	.571	.554
San Juan, P. R.....	29.854	.841	.837	.840	.852	.863	.875	.886	.891	.888	.877	.861	.846	.831	.824	.824	.827	.842	.855	.868	.878	.880	.875	.867	.858
Santiago de Cuba...	29.814	.804	.796	.799	.809	.820	.829	.834	.844	.840	.827	.813	.791	.772	.759	.759	.769	.781	.798	.815	.838	.841	.838	.830	.809
Santo Domingo, S. D.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Willemstad, Curaçao	29.794	.785	.776	.781	.792	.803	.823	.832	.836	.831	.813	.791	.755	.732	.715	.708	.717	.734	.766	.782	.813	.819	.820	.812	.785

TABLE V.—*Average wind movement for each hour of seventy-fifth meridian time, September,* 1899.

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midnight.	Mean.
Abilene, Tex.	7.1	6.6	7.0	6.5	6.4	5.9	5.1	4.2	4.8	6.9	8.8	9.3	10.6	10.6	10.9	11.0	10.7	10.7	10.8	10.0	7.3	6.5	6.7	7.0	8.0
Albany, N. Y.	5.4	5.8	5.1	5.5	5.7	5.6	6.2	8.0	9.6	10.1	10.3	10.7	11.4	11.1	10.6	10.2	9.5	8.1	7.2	7.2	6.4	6.3	6.1	5.8	7.8
Alpena, Mich.	7.7	7.1	6.9	7.5	7.2	7.0	6.9	7.2	7.6	7.9	8.1	8.7	9.4	8.8	9.0	8.7	8.4	8.0	7.9	7.2	6.8	6.8	7.4	7.7	7.8
Amarillo, Tex.	14.1	14.3	15.0	14.7	14.2	14.7	13.7	13.5	13.1	13.5	16.9	17.1	16.8	15.8	15.2	15.2	15.2	14.9	14.5	13.1	12.5	13.8	13.8	13.7	14.6
Atlanta, Ga.	9.2	8.6	8.2	7.9	7.9	8.1	8.6	8.2	7.9	8.4	8.7	9.3	9.6	9.3	9.4	9.6	9.7	9.2	8.5	8.5	9.8	10.1	9.6	8.9	8.9
Atlantic City, N. J.	9.9	9.3	8.5	7.9	8.3	8.0	8.4	9.2	10.3	10.4	10.5	10.7	11.1	12.3	12.3	12.0	11.4	10.8	10.1	10.1	10.2	10.5	10.1	10.1	10.1
Augusta, Ga.	3.5	3.7	3.9	3.8	4.1	4.0	3.9	4.2	5.4	6.2	6.4	6.4	7.0	7.2	7.8	7.6	7.3	6.1	5.4	5.0	4.4	4.6	3.9	3.9	5.2
Baker City, Oreg.	5.1	6.8	7.3	8.6	8.4	8.9	8.9	9.1	9.2	9.1	7.5	4.2	3.6	4.6	5.1	5.9	7.0	7.5	7.0	7.0	5.6	4.2	3.4	4.4	6.6
Baltimore, Md.	3.2	3.3	3.2	3.3	3.4	3.4	3.4	4.2	5.0	5.5	5.9	6.1	6.5	6.6	6.9	6.6	6.3	5.2	4.5	4.0	4.0	4.1	3.9	3.7	4.7
Bismarck, N. Dak.	5.8	6.4	6.7	6.3	6.3	6.4	6.2	7.1	8.3	10.2	11.4	12.6	14.0	15.0	15.7	15.7	15.4	14.9	13.6	10.9	9.3	8.8	7.9	7.0	10.1
Block Island, R. I.	14.8	14.7	14.8	15.3	14.5	13.8	14.2	15.4	16.3	16.2	15.6	15.3	15.3	15.8	16.4	16.8	16.3	15.4	14.5	14.8	15.3	16.3	16.7	15.9	15.4
Boise, Idaho	3.8	3.0	3.4	3.0	2.6	2.7	2.3	2.3	2.0	2.0	2.1	2.5	3.1	3.5	4.4	4.5	5.1	5.3	5.2	4.5	3.7	3.0	3.5	3.7	3.4
Boston, Mass.	8.7	8.6	7.9	8.4	8.6	8.6	9.4	10.1	11.5	11.6	11.4	11.9	12.0	13.4	13.5	13.7	12.4	10.8	9.7	10.0	10.0	9.5	9.1	8.9	10.4
Buffalo, N. Y.	12.9	13.7	12.7	13.4	13.3	13.6	13.3	12.8	13.0	13.0	12.9	13.2	13.9	14.7	14.7	14.8	14.0	13.1	13.6	13.4	12.7	12.8	13.6	13.2	13.4
Cairo, Ill.	6.0	5.9	5.5	5.4	5.7	5.3	5.6	5.8	6.9	7.7	8.0	8.8	9.5	8.9	8.5	8.6	8.9	7.6	5.9	5.8	5.1	5.5	5.6	5.3	6.7
Cape Henry, Va.	11.5	11.7	11.5	11.6	11.9	10.8	11.0	12.0	11.9	11.9	11.9	12.5	13.7	13.0	12.9	12.8	12.4	11.4	11.4	11.6	11.7	11.8	12.9	11.8	12.0
Carson City, Nev.	5.0	5.0	3.9	2.6	2.8	2.7	2.5	2.2	1.8	1.7	1.6	2.7	3.7	4.7	6.5	7.5	8.3	9.3	9.0	10.0	8.9	7.3	6.6	6.3	5.1
Cedar City, Utah.	7.5	8.2	7.5	7.4	7.4	7.0	7.1	7.2	7.5	5.8	3.7	3.6	5.0	5.7	6.6	6.9	7.2	7.4	7.0	6.0	5.3	5.3	6.1	7.1	6.5
Charleston, S. C.	7.6	7.6	8.3	8.8	8.9	8.5	9.3	10.1	10.4	9.6	9.6	9.9	10.4	11.9	12.3	12.9	13.2	12.2	10.6	10.8	10.3	9.1	8.9	8.5	10.0
Charlotte, N. C.	4.3	4.4	4.4	4.6	5.1	4.6	4.7	5.1	5.7	6.2	6.5	6.4	6.2	6.5	6.4	6.6	6.5	5.4	4.0	4.3	4.6	4.7	4.5	4.4	5.2
Chattanooga, Tenn.	4.4	4.3	4.4	3.9	4.1	4.2	4.1	4.0	4.5	5.2	7.1	7.1	7.8	8.0	8.5	9.4	8.8	8.5	7.4	4.9	4 5	4.0	4.0	4.6	5.7
Cheyenne, Wyo.	7.0	7.2	7.2	7.5	7.7	7.1	7.9	7.9	7.1	7.0	8.6	9.1	10.1	10.9	12.0	12.5	12.6	11.9	11.6	11.0	8.4	7.1	7.2	6.1	8.9
Chicago, Ill.	17.6	17.7	18.2	17.2	15.7	15.6	15.2	16.2	16.4	14.9	16.8	16.3	17.4	17.9	18.3	17.9	19.1	18.0	16.6	16.2	16.0	16.1	16.5	17.5	16.9
Cincinnati, Ohio.	5.0	5.0	4.7	4.2	4.7	4.6	4.8	5.6	6.5	8.3	9.1	10.3	10.6	10.5	10.4	11.0	10.6	9.6	7.6	6.2	6.1	6.0	5.6	5.3	7.2
Cleveland, Ohio.	15.9	15.8	16.3	14.8	14.6	14.7	15.0	15.2	14.6	14.7	15.0	15.3	15.4	14.5	14.3	14.7	15.5	14.7	14.8	13.8	14.0	14.4	15.6	15.7	15.0
Columbia, Mo.	5.5	5.6	5.4	5.5	5.4	5.1	5.2	5.9	6.2	7.5	8.1	8.5	9.0	9.0	9.4	9.0	8.4	8.3	6.7	5.7	5.7	5.7	6.2	5.9	6.8
Columbus, Ohio.	5.8	5.7	5.5	4.9	5.5	5.6	5.9	6.2	7.3	8.1	9.1	9.4	9.9	10.3	10.5	10.3	9.8	9.0	7.5	7.4	6.6	6.4	6.1	5.8	7.4
Concordia, Kans.	6.4	6.0	5.4	5.5	5.5	4.9	4.2	4.3	5.4	7.1	8.3	9.0	9.3	9.7	9.8	10.0	9.6	9.5	8.6	6.3	4.7	5.3	6.6	6.5	7.0
Corpus Christi, Tex.	9.9	8.9	7.9	7.5	6.7	6.0	6.0	6.2	6.4	6.9	7.3	8.6	9.5	10.8	11.8	14.1	14.0	13.8	13.8	13.0	12.5	11.9	11.3	10.7	9.8
Davenport, Iowa.	5.8	5.6	5.5	5.3	5.7	6.2	6.4	6.3	7.2	7.5	8.1	8.7	9.1	9.6	9.4	9.0	9.0	8.3	6.5	5.0	4.4	4.8	5.1	5.3	6.8
Denver, Colo.	6.8	6.9	6.7	7.4	7.1	7.1	7.1	7.4	7.0	6.2	6.0	6.4	6.4	7.3	8.0	7.6	8.4	9.0	8.8	7.9	6.5	6.8	6.7	7.3	7.2
Des Moines, Iowa.	5.7	5.7	6.1	5.9	5.7	5.5	5.4	5.9	6.7	7.9	9.6	10.4	10.9	11.4	11.4	11.6	11.3	11.0	9.0	6.5	6.3	6.3	6.5	6.2	7.9
Detroit, Mich.	7.8	8.4	7.7	7.8	8.1	8.1	8.1	8.7	8.3	8.4	9.5	10.2	10.6	11.3	11.1	11.1	11.2	10.5	9.0	8.6	8.7	8.6	8.1	7.8	9.1
Dodge, Kans.	9.1	8.8	8.5	8.2	7.5	7.5	7.7	8.4	8.5	11.1	13.0	14.1	14.5	15.2	16.0	15.9	14.9	14.7	13.5	10.9	10.5	10.0	10.0	9.8	11.2
Dubuque, Iowa.	5.6	5.3	5.5	5.2	6.0	5.7	6.2	6.4	7.8	8.8	9.6	10.2	11.1	11.1	11.3	11.1	10.5	9.1	7.5	5.7	4.9	5.2	5.8	5.4	7.5
Duluth, Minn.	7.9	8.4	9.0	9.2	9.5	9.0	8.7	9.2	9.2	9.3	9.7	10.1	10.8	10.3	10.4	11.1	10.9	9.4	8.2	7.7	8.4	8.7	8.3	8.3	9.2
Eastport, Me.	8.2	8.2	9.1	9.9	9.6	9.6	9.6	10.2	11.1	11.1	11.0	11.8	12.0	12.9	12.7	12.2	12.2	10.8	9.3	9.5	9.7	9.2	8.8	8.2	10.3
Elkins, W. Va.	2.2	2.1	2.5	2.2	2.1	1.8	1.9	2.0	2.9	3.3	4.6	5.7	6.2	6.0	5.9	5.8	5.2	4.3	2.9	2.0	1.7	2.0	2.1	1.9	3.3
El Paso, Tex.	8.1	8.6	9.4	9.3	9.0	8.8	8.5	8.5	7.5	8.2	8.4	8.1	8.2	8.3	8.5	8.6	8.8	8.3	8.3	8.8	8.1	6.8	7.4	7.7	8.3
Erie, Pa.	11.2	11.8	11.6	11.9	11.4	11.9	11.1	11.9	11.6	10.8	11.2	11.3	11.5	11.4	11.8	11.4	10.8	10.4	9.5	10.3	10.7	11.3	12.0	11.8	11.3
Escanaba, Mich.	8.6	7.7	8.1	8.0	7.6	7.6	8.1	8.1	9.5	10.1	11.7	12.2	12.6	12.6	12.6	12.7	13.0	12.2	11.6	11.0	9.8	9.1	8.3	8.5	10.1
Eureka, Cal.	3.1	2.9	2.9	3.1	3.0	2.7	2.7	2.7	2.4	2.4	2.5	2.9	3.3	4.4	5.1	6.2	6.5	6.7	6.6	6.2	5.9	4.9	3.9	3.5	4.0
Evansville, Ind.	4.6	5.0	4.7	4.9	4.9	4.8	4.7	5.1	6.5	7.2	7.8	8.7	9.3	8.8	8.3	8.3	8.0	7.7	6.3	4.9	5.2	4.9	5.0	4.8	6.3
Fort Canby, Wash.	7.8	8.2	8.5	7.8	7.8	7.7	8.5	8.7	8.7	8.4	7.6	7.2	7.5	7.9	8.4	9.5	10.1	9.6	9.2	10.2	10.9	10.8	10.9	9.0	8.8
Fort Smith, Ark.	5.1	5.0	5.3	5.0	5.0	4.7	4.8	4.4	4.9	5.5	5.5	6.5	8.4	8.4	8.6	9.0	8.4	7.7	7.2	5.7	5.6	5.2	5.0	4.9	6.1
Fresno, Cal.	7.5	7.6	7.2	6.3	5.5	5.2	4.7	4.8	4.1	4.0	4.0	4.5	5.1	4.8	4.6	4.6	5.2	5.0	5.8	5.5	5.2	5.4	6.3	6.8	5.4
Galveston, Tex.	7.0	6.9	6.3	6.3	6.4	6.2	6.4	6.5	7.2	7.7	8.1	8.0	8.4	8.2	8.1	8.0	8.1	8.1	7.4	7.0	7.0	7.0	6.7	7.1	7.3
Grand Haven, Mich.	7.2	7.2	7.3	7.1	7.0	6.4	6.5	6.7	8.4	9.6	10.4	11.8	11.8	12.0	12.0	12.2	11.6	10.2	8.9	7.7	7.7	7.5	8.1	7.7	8.9
Grand Junction, Colo.	3.6	3.7	4.5	4.7	5.5	5.5	5.8	5.5	5.9	6.2	6.6	7.1	6.6	5.7	5.6	5.9	6.5	6.8	6.3	5.0	3.5	3.3	3.2	3.5	5.3
Green Bay, Wis.	7.1	7.0	7.0	6.9	7.3	7.2	6.7	7.4	8.0	9.7	10.6	10.6	10.7	10.4	10.5	9.8	9.3	9.1	8.3	8.4	8.4	8.4	7.9	7.3	8.5
Hannibal, Mo.	7.5	6.9	6.3	6.7	7.0	6.2	6.6	6.4	7.4	9.2	10.2	10.5	10.8	10.9	10.2	10.0	9.6	8.5	6.6	4.8	5.3	5.7	5.9	6.5	7.7
Harrisburg, Pa.	4.3	4.3	3.8	4.0	3.6	3.5	3.6	4.7	5.8	5.9	7.3	8.3	8.9	8.9	8.6	8.7	7.8	7.6	6.1	5.-	5.8	5.1	5.0	4.9	5.9
Hatteras, N. C.	10.2	9.8	9.4	10.2	10.4	10.9	11.4	12.0	12.6	12.7	12.7	12.4	12.6	12.6	12.3	12.1	12.0	11.0	10.4	11.1	10.5	10.1	10.0	10.3	11.2
Havre, Mont.	7.6	6.9	7.6	8.1	7.7	6.8	7.2	6.9	7.7	10.1	11.7	11.6	12.8	14.1	13.8	13.3	13.7	13.1	12.8	10.4	8.5	6.6	6.3	7.3	9.7
Helena, Mont.	8.3	8.0	7.8	7.0	7.7	7.3	6.2	6.1	6.2	5.8	7.2	7.4	7.1	8.0	8.9	9.8	10.4	10.0	9.3	8.1	8.5	9.3	8.9	9.3	8.0
Huron, S. Dak.	10.3	10.1	9.7	9.8	9.6	10.1	9.7	9.2	9.2	11.4	13.3	14.3	14.7	15.3	15.8	16.0	15.9	15.2	13.6	12.0	10.3	10.7	11.4	11.3	12.0
Independence, Cal.	5.7	6.0	6.1	7.2	7.3	6.9	7.3	7.0	7.5	8.4	9.0	7.5	8.2	7.1	5.9	6.2	7.9	8.5	8.4	8.3	8.4	8.5	8.2	7.6	7.5
Indianapolis, Ind.	7.2	7.2	7.3	7.1	7.0	6.7	6.7	7.1	8.1	9.5	10.3	10.9	11.4	11.8	11.8	11.6	12.2	10.9	9.6	8.7	8.5	8.0	7.7	7.6	8.9
Jacksonville, Fla.	5.2	4.9	4.8	5.5	5.3	4.9	4.6	5.1	5.8	6.4	7.6	8.0	8.2	9.0	9.6	9.9	10.0	8.9	7.4	6.1	5.2	4.9	5.0	5.4	6.6
Jupiter, Fla.	7.2	7.1	6.4	5.9	5.6	6.1	6.0	6.4	7.0	7.9	8.2	8.4	8.5	9.8	10.0	9.4	9.6	9.3	8.3	8.9	8.9	9.0	8.7	8.5	7.9
Kalispell, Mont.	6.0	5.0	4.7	5.7	5.3	5.9	5.6	6.0	6.1	5.3	5.1	4.2	4.6	5.5	7.2	7.5	7.9	7.5	6.7	5.6	3.5	3.7	4.8	5.4	5.6
Kansas City, Mo.	6.8	6.6	6.8	6.9	6.7	6.7	6.4	6.7	7.8	8.2	8.8	9.7	10.1	9.9	10.5	9.9	9.9	9.8	8.5	6.7	7.0	6.9	6.8	6.9	8.0
Keokuk, Iowa.	5.5	5.1	5.1	5.2	5.4	5.3	5.8	6.4	6.9	7.7	8.3	8.9	8.5	9.3	9.6	9.4	8.6	7.4	5.7	4.6	4.1	4.6	5.3	5.6	6.6
Key West, Fla.	6.0	5.7	5.9	5.6	5.4	5.3	6.1	6.5	7.0	7.4	7.6	8.8	9.2	8.2	8.0	7.6	7.8	7.4	7.0	6.9	6.7	6.9	5.9	5.7	6.9
Kittyhawk, N. C.	11.5	11.9	12.0	12.5	12.7	12.5	13.1	12.9	13.7	14.1	14.2	13.8	13.8	14.9	16.0	15.5	15.2	14.2	13.4	13.6	13.5	13.5	12.2	12.1	13.4
Knoxville, Tenn.	4.0	3.9	3.9	3.8	3.6	3.6	3.5	3.9	5.5	5.6	6.6	6.7	7.2	7.3	8.0	8.8	9.1	8.6	7.1	6.4	5.3	4.9	4.2	4.4	5.7
La Crosse, Wis.	5.1	5.0	5.6	5.8	5.4	6.1	5.8	5.6	6.6	7.5	7.7	7.9	8.5	8.7	8.9	8.7	7.9	7.2	6.5	5.8	5.6	5.4	5.3	5.8	6.6
Lander, Wyo.	3.7	2.9	2.8	3.2	2.8	2.4	2.4	2.4	2.1	2.0	2.4	3.7	5.0	5.7	5.8	6.4	7.1	6.2	6.2	5.4	4.7	4.4	4.2	3.9	4.1
Lexington, Ky.	8.2	7.6	7.5	7.7	7.6	7.3	7.6	8.0	8.7	10.0	10.5	10.4	10.4	10.6	10.5	10.2	10.0	9.8	8.7	8.1	8.0	7.7	7.7	8.5	8.8
Little Rock, Ark.	3.7	4.3	4.6	4.5	4.3	4.1	4.3	4.2	4.8	5.8	6.6	7.1	8.2	7.8	7.9	8.1	8.1	8.1	6.1	4.5	3.8	3.9	3.8	3.5	5.5
Los Angeles, Cal.	2.3	1.9	1.9	1.8	1.5	1.4	1.3	1.3	1.2	1.1	1.7	2.7	3.9	4.0	5.4	6.9	7.9	8.2	7.7	6.7	5.1	3.5	2.5	2.2	3.5
Louisville, Ky.	4.4	4.4	4.1	4.2	4.6	4.6	4.9	4.9	5.7	6.6	7.7	8.3	8.4	8.2	8.5	7.9	7.4	7.4	5.6	5.7	5.3	5.2	5.1	5.0	6.0
Lynchburg, Va.	1.1	1.3	1.0	1.0	0.9	0.9	1.2	1.6	3.0	4.1	4.3	4.7	5.0	5.0	4.8	5.3	5.3	4.7	2.9	2.1	1.8	1.8	1.6	1.4	2.8
Macon, Ga.	5.3	5.0	4.9	5.1	4.9	4.9	5.0	5.6	6.2	6.5	7.7	7.5	8.0	8.6	8.6	9.2	8.5	7.6	6.4	5.4	5.1	5.2	5.2	5.5	6.3
Marquette, Mich.	9.7	10.0	10.3	10.3	11.6	11.7	10.4	11.0	11.8	12.3	12.7	13.4	13.6	14.1	12.4	11.1	11.0	9.7	8.6	8.9	8.4	8.6	9.4	10.0	10.9
Memphis, Tenn.	3.8	3.7	3.6	3.9	3.9	3.7	4.0	4.0	4.2	4.8	5.5	6.2	6.2	6.4	6.7	6.1	5.7	5.7	4.7	4.0	3.9	3.4	3.9	3.9	4.7
Milwaukee, Wis.	11.4	11.2	10.8	9.8	10.1	10.2	10.4	10.6	11.6	12.5	13.0	13.4	14.8	15.3	15.4	15.3	14.6	13.4	11.7	10.3	10.6	10.2	10.8	11.1	12.0
Minneapolis, Minn.	11.3	11.9	12.1	11.6	11.3	11.1	11.4	12.3	12.3	12.5	12.8	13.7	13.4	13.9	13.6	12.8	13.0	12.6	11.7	11.2	11.8	11.2	11.4	11.2	12.2
Mobile, Ala.	4.8	4.6	4.2	4.6	4.9	5.0	5.0	5.3	6.1	6.6	6.4	7.0	7.2	7.5	8.3	8.4	8.2	8.0	6.5	5.7	5.2	5.2	5.1	5.0	6.0
Montgomery, Ala.	3.3	3.5	3.2	3.3	3.2	3.4	3.3	3.8	4.9	5.8	6.0	6.3	7.1	7.1	7.2	7.0	6.8	6.5	5.0	3.8	4.1	4.0	3.9	3.7	4.8
Moorhead, Minn.	8.9	8.9	9.6	9.4	9.9	9.6	9.5	9.4	9.6	10.4	11.5	12.2	13.0	13.7	14.4	13.6	13.3	12.6	11.4	9.9	8.7	9.1	8.9	9.3	10.7
Mount Tamalpais, Cal.	24.0	23.3	22.7	22.9	21.0	20.7	20.5	19.8	19.2	16.9	14.2	12.8	11.0	9.3	3.9	9.1	9.5	11.2	13.6	15.2	17.9	20.3	22.2	24.2	17.1
Nantucket, Mass.	8.5	9.0	9.0	9.2	9.1	8.8	9.0	10.3	11.5	11.9	12.1	12.4	12.6	12.9	13.5	12.8	12.1	9.9	9.5	10.1	9.9	9.2	9.5	9.6	10.5
Nashville, Tenn.	3.9	3.5	3.2	3.2	3.1	3.1	3.2	3.6	4.4	6.4	7.2	7.9	7.9	7.6	7.4	8.1	8.5	8.1	6.6	5.3	4.6	5.1	5.0	4.2	5.5
Neah, Wash.	3.9	3.9	4.2	4.3	4.0	3.7	3.5	3.4	3.0	3.5	3.9	4.7	5.1	5.0	4.9	5.7	5.3	6.4	6.4	6.3	6.5	4.9	4.1	4.1	4.6

TABLE V.—*Average wind movement, etc.*—Continued.

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midnight.	Mean.
New Haven, Conn....	6.6	6.6	6.7	6.8	6.2	6.5	7.0	7.6	8.9	10.0	10.7	10.9	12.0	11.7	11.7	11.3	10.3	8.3	8.0	7.5	7.5	7.1	6.7	7.1	8.5
New Orleans, La.....	6.3	6.3	6.1	6.6	7.1	7.4	7.4	7.2	8.4	9.7	9.6	9.7	10.2	10.8	10.5	9.9	9.1	8.0	7.7	7.1	7.3	7.3	7.2	6.5	8.1
New York, N. Y.....	11.4	11.2	11.5	11.1	10.5	10.4	11.3	12.2	12.2	13.7	13.7	14.2	15.2	15.3	15.8	17.2	17.1	16.2	14.2	14.8	14.7	14.5	14.0	13.0	13.6
Norfolk, Va.....	5.9	5.7	5.7	6.0	6.1	6.4	5.9	6.6	7.8	8.5	9.6	10.2	10.3	10.8	10.5	11.1	10.6	9.5	7.9	7.3	7.6	7.8	7.0	6.4	8.0
Northfield, Vt.....	7.5	7.3	7.3	7.7	7.7	8.0	7.3	8.5	10.1	12.0	12.9	12.9	12.9	12.7	13.5	13.1	11.2	9.8	8.6	8.2	8.3	8.1	8.2	8.0	9.6
North Platte, Nebr...	6.8	6.0	5.8	5.9	5.7	6.2	6.9	7.0	6.5	7.1	8.5	9 5	10.6	11.4	11.5	11.5	10 9	10.5	9.8	8.9	7.5	7.4	7.5	7.6	8.2
Oklahoma, Okla.....	6.5	6.2	5.8	5.8	6.2	5.8	5.7	5.5	6.3	7.9	8.3	8.8	8.6	8.8	9.1	9.3	9 1	8.7	7.5	6.2	6.2	6.2	6.2	6.5	7.1
Omaha, Nebr.....	6.5	6.3	6.1	6 0	5.8	5.5	5.4	6.2	6.8	8.2	9.2	10.3	11.0	11.1	11.7	12.1	11.5	10.5	8.5	7.6	7.1	7.4	6.9	7.4	8.1
Oswego, N. Y.....	10.1	10.0	10 2	10.3	10.7	10.8	10.9	11.4	12.5	12.5	12.4	12.3	12.9	12.6	11.5	11.5	10.4	9.5	9.5	9.5	9.7	10.2	9.8	9.3	10.9
Palestine, Tex.....	4.2	4.2	3 9	3.8	3.8	3.4	3.5	3.8	4.7	6.9	7.8	7.0	7.4	7.0	7.3	7.4	7.7	7.4	6.0	4.1	3.9	4.2	4.3	4.2	5.3
Parkersburg, W. Va..	4.0	4.6	4.3	4.6	4.5	4.3	3.9	4.4	5.0	5.9	6.5	7.1	7.5	7.5	7.8	7.8	6.6	5.6	5.1	4.5	4.7	4.3	4.5	3.8	5.4
Pensacola, Fla.....	6.7	7.3	7.6	7.5	8.3	8.0	8.2	8.4	9.2	9.6	9.7	9.9	9.4	9.3	9.6	10.1	10.3	9.3	7.5	6.8	7.6	7.9	7.8	7.4	8.5
Phenix, Ariz.....	3.5	3.9	4.0	3.5	3.8	3.7	4.2	3.9	4.6	4.1	4.5	5.0	5.3	5.0	4 7	4.9	4.6	4.7	5.1	3.9	3.2	2.8	2.9	2.9	4.1
Philadelphia, Pa.....	7.2	6.8	6.7	7.4	6 7	6.7	6.9	7.9	8.3	9.2	9.6	9.9	10.9	11.1	11.3	11.3	10.9	10.2	9.3	8.2	8.5	8.2	8.3	8.0	8.7
Pierre, S. Dak.....	9.1	8.6	8.2	7.9	7.3	7.0	7.3	7.4	7.8	9.9	12.3	13.2	14.9	15.2	14.7	15.0	14.6	14.3	13.6	11.9	11.3	11.5	11.4	10.8	11.0
Pittsburg, Pa.....	4.6	4.6	4.9	4.4	4.9	4.9	4.9	5.6	5.7	6.3	6.9	7.5	8.0	8.2	7.8	7.8	8.1	7.4	6.2	5.1	5.1	5.0	5.0	4.8	6.0
Pocatello, Idaho.....	10.4	10.6	10.8	9.6	8.4	9.3	10.4	10.9	10.7	9.2	8.8	8.4	8.6	8.4	8.9	8.8	9.5	9.6	9.0	7.5	6.0	6.7	8.9	10.4	9.2
Point Reyes Lt., Cal..	17.0	16.3	15.2	14.6	14.2	14.0	14.3	14.7	14.5	14.6	14.2	14.6	15.0	15.8	17 1	17.3	16.9	17.4	17.9	17.9	18.1	17.7	17.3	16.0	15.9
Port Crescent, Wash.	2.7	2.6	2.7	2.7	2.6	2.5	2.8	2.7	2.6	2.7	2.7	3.8	5.7	7.0	6.6	6.7	6.7	6.7	5.2	4.6	4.2	3.7	3.1	2.8	4.0
Port Huron, Mich....	10.1	9.8	9.3	9.2	9.4	8.9	9.6	9.9	11.0	11.1	11.3	11.7	13.2	12.8	12.0	12.1	12.4	10.9	10.6	10.4	10.2	10.5	10.9	10.7	10.7
Portland, Me.....	5.7	5.8	5.8	5.8	6.0	6.4	6.5	7.1	8.5	9.2	9.4	10 1	10.7	11.1	10.9	10.5	9.4	7.8	6.7	6.5	6.4	6.6	6.0	6.1	7.7
Portland, Oreg.....	6.5	6.0	5.9	5.8	5.9	6.6	6.2	5.9	5.7	5.8	6.1	7.0	7.1	7.1	7.0	7.4	7.4	7.3	7.4	7.3	7.2	7.2	6.9	6.5	6.6
Pueblo, Colo.....	6.7	5.9	5.2	5.1	5.5	5.4	4.4	3.9	5.8	3.5	4 6	5.5	6.2	6.5	7.1	8.3	8.7	8.6	8.4	8.2	6.9	5.8	4.6	5.6	6.0
Raleigh, N. C.....	4.0	4.3	4.1	4.4	3.6	3.9	4.1	5.0	5.9	6.7	6.9	6.5	6.0	6.4	6.5	5.9	6.1	5.0	4.0	4.0	4.4	4.7	4.7	4.4	5.1
Rapid City, S. Dak...	5.1	5.5	5 2	5.3	5.3	4.6	5.1	5.0	5.0	5.9	7.1	7.6	9.0	9.4	9.4	9.3	9.1	8.5	7.5	6.6	4.4	4.3	5.1	5.0	6.4
Red Bluff, Cal.....	4.8	4.6	4.3	5.0	5.2	4.7	4.5	4.5	4.7	4.5	4.5	6.1	6.9	6.3	6.0	5.9	6.1	5.9	6.1	6.4	6.0	5.3	5.5	5.2	5.4
Richmond, Va.....	3.9	3.8	3.3	3.3	3.2	3.3	3.8	4.5	5.1	5.7	6.6	6.8	6.3	6.7	6.6	6.6	6.4	6.2	5.9	5.6	4.7	4.5	4.3	4.0	5.0
Rochester, N. Y.....	6.1	6.2	6.0	6.6	6.8	6.6	6.4	7.4	8.1	8.3	8.8	9.4	9.8	9.9	9.4	9.1	8.5	7.3	6.1	6.0	5.8	5.7	6.1	6 6	7.4
Roseburg, Oreg.....	2.0	2.0	1.5	1.4	1.4	1.9	1.7	1.3	1.6	1.6	2 0	2.4	3.1	3.9	4.3	5.0	5.5	6.6	6.7	7.0	6.1	3.7	2.6	2.4	3.2
Sacramento, Cal.....	8.5	7.8	8.1	8.2	8.2	7.9	6.5	5.8	5.8	5.3	4.9	4.8	5.0	5.4	5.7	6.5	6.4	6.4	6.5	6.4	6.8	8.1	8.2	8.1	6.7
St. Louis, Mo.....	8.6	8.8	9.2	8.6	8.5	8.1	8.2	8.3	9.2	9 2	9.6	10.4	11.0	11 2	11.3	11.4	11.6	11.0	9.9	9.4	9.8	9.8	9.1	8.7	9.6
St. Paul, Minn.....	6.4	6.8	6.5	6.8	6.6	7.0	6.5	7.0	7.6	8.4	9.0	9.6	9.8	10 5	10.3	9.5	9.7	9.6	8.6	7.4	7.1	6.5	6.6	6.1	7.9
Salt Lake City, Utah.	4.4	3.9	3.1	2.9	3.2	3.4	3.7	3.0	3.2	2.8	2.4	3.1	5.9	7.0	8.2	9.6	10.5	10.2	8.8	7.1	4.6	4.5	4.8	4.6	5.2
San Antonio, Tex.....	6.5	5.4	4.7	4.2	4.1	4.4	4.6	4.8	5.0	6.1	7.1	7.7	7.7	8.3	8.4	8.9	8.7	9.5	10.4	9.4	9.0	8.9	8.7	7.3	7.1
San Diego, Cal.....	2.7	2.8	2.8	3.0	2.8	2.6	2.3	2.4	2.6	2.5	2.8	4 4	7.0	9.0	10.2	10.6	10,6	9.8	8.9	7.7	6.8	5.2	4.0	3.4	5.3
Sandusky, Ohio	8.6	9.4	8.9	8.9	8.6	8.4	8.1	8.5	9.1	9.5	9.5	9.5	10.1	9.5	9.8	9 9	9.3	8 8	8.2	8.0	8.3	9.1	9.4	9.4	9.0
Sandy Hook, N.J	16.1	16.6	16.2	16.2	15.4	15.5	15.7	16.6	15.7	16.1	16.7	16.9	17.7	18 3	19.0	18.7	18.8	18.5	16.9	18.4	17.2	17.8	17.6	16.9	17.1
San Francisco, Cal...	12.9	11.3	10.0	9.1	8.9	8.2	7.2	7.2	7.0	6.4	6.4	6.3	7.0	8.9	12.3	15.7	18.1	20.5	23.2	23.7	22.7	18.0	16.9	14.4	12.6
San Luis Obispo, Cal.	2.6	2.4	2.6	2.7	2.5	3.1	3.0	3.1	3.1	3.1	3.7	4.3	4 7	5.2	5.9	7.3	7.5	8.1	7.5	6.7	5 8	4.5	3.8	3.0	4.4
Santa Fe, N. Mex.....	6.9	6.1	5.1	4.2	3.7	3.2	3.4	3.0	2.9	2.6	3.9	4.8	6.2	7.3	8.3	7.8	7.1	7.0	6.8	6.4	5.8	6.4	6.7	6.3	5.5
Sault Ste. Marie, Mich	7.2	6.7	7.4	7.5	7.2	7.9	7.6	8 2	8.3	8.7	9.9	10.8	11.7	13.1	14.3	14.5	13.7	12.0	10.3	9.5	9.1	7.6	7.0	6.7	9.5
Savannah, Ga.....	4.5	4.7	5.2	5.2	6 0	5.9	5.4	6.1	7.3	7.4	7.8	8.4	9.0	8.7	9.0	9.3	9.1	8.3	6.8	6.2	5.8	5.3	4.9	4.7	6.7
Seattle, Wash.....	2.8	2.6	2.7	2.9	3.0	2.8	2 6	2.4	2.5	3.2	3.4	4.0	4.4	5.1	5.6	5.4	5.7	5.6	5.5	5.2	5.1	4.5	3.6	3.3	3 9
Shreveport, La.....	4.7	4.5	4.5	4.3	4.2	3.8	3.7	3.8	5.1	6.5	6.8	6.7	7.0	7.2	7.6	8 3	8 1	8.1	7.4	6.1	5.8	5.5	5.2	5.2	5.8
Sioux City, Iowa.....	10.9	9.9	9.9	10.3	10.1	10.4	10.3	11.6	10.7	11.2	12.7	15.3	17.1	16.6	16.8	16.9	16.2	15.2	13.7	12.2	12.4	12.9	12.6	12.0	12.8
Spokane, Wash.....	3.7	3.9	3.2	3.4	3.5	3.5	3.5	3.6	3.4	3.5	4.9	5.5	5.7	5.5	5.5	6.0	6.0	6.0	5.3	5.1	4.4	4.5	3.9	3.7	4.5
Springfield, Ill.....	7.2	7.3	6.9	6.8	7 2	7.2	7.2	7.1	8.2	8.7	9.1	9.5	9.6	9.8	10.1	10.0	9.6	8.9	6.9	5.9	6.4	6.9	7.1	6.8	7.9
Springfield, Mo.....	8.7	8.7	8.5	8.1	8.0	7.8	8.2	7.9	8.3	9.3	10.5	10.8	11.2	10.9	11.0	10.9	11.6	11.2	9.7	7.8	7.7	8.1	8.8	8.9	9.3
Tacoma, Wash.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Tampa, Fla.....	4.1	4.1	4.1	3.8	3.8	3.8	3.5	4.8	5.9	6.7	6.9	7.2	6.5	6.9	7.9	7.6	7.5	6.8	5.2	5.1	4.9	4.5	4.1	4.2	5.4
Toledo, Ohio.....	7.8	7.8	7.9	7.5	7.9	7.9	7.7	8.1	8.6	9.6	9.8	10.0	10.3	11.2	10.8	11.0	10.8	10.1	8.4	7.7	8.0	8.3	8.2	7.9	8.9
Vicksburg, Miss.....	5.5	6.3	5.7	5.5	5.2	5.1	4.7	4.8	4.7	5.3	5.3	5.5	6.9	6.6	6.7	6.6	6.4	5.6	5.3	4.1	4.4	4.8	5.3	5.5	5.5
Vineyard Haven, Mass	7.7	7.4	7.3	7.1	6.8	7.0	6.9	8.0	8.9	9.6	9.6	9.9	10.4	10.4	10.2	9.8	8 8	8.0	7.5	7.4	8.1	8.4	8.3	8.4	8.4
Walla Walla, Wash...	4.3	4.5	4.3	4.6	4.5	4.6	4.2	4.3	4.2	3.7	3.4	3.9	4.4	4.8	4.8	4.8	4.6	4.6	4.1	3.5	3.4	4.6	5.2	4.7	4.3
Washington, D. C.....	3.9	3.7	3.8	3.9	3.9	3.7	3.6	4.0	5.9	7.1	8.4	8.7	8.9	9.2	9.0	8.8	8.0	6.2	5.2	4.4	4.9	4.4	4.3	4.4	5.8
Wichita, Kans.....	7.1	6.9	6.4	6.8	6.5	6.0	6.2	6.1	6.9	7.9	9.1	10.6	11.0	11.6	11.2	11.4	11.0	10.0	8.5	7.0	6.8	7.1	7.3	7.3	8.2
Williston, N. Dak.....	6.5	5.8	5.2	5.4	6.1	6.2	5.8	5.3	6.5	8.2	10 0	11.7	13.8	14.8	17.2	17.4	16.6	15.5	14.4	11.6	9.6	9.6	8.2	7.2	9.9
Wilmington, N. C.....	4.7	4.6	5.2	5.2	5.3	5.6	5.8	6.9	8.1	8.4	8.6	8.0	8.9	9.2	8.8	8.9	8.2	7.2	5.5	5.0	5.0	5.4	5.2	4.6	6.6
Winnemucca, Nev ...	7.3	7.6	8.4	8.1	7.9	7.1	7.1	7.2	6.9	6.4	6.4	7.0	8.4	8.8	8.9	9.3	9.3	9.9	9.9	8.3	7.3	5.6	5.8	6.4	7.7
Woods Hole, Mass.....	13.5	13.5	13.0	12.6	12.8	12.7	12.5	13.6	14.0	14.2	13.8	14.7	15.0	14.7	14.8	14.4	14.1	13.3	12.7	12.4	12.6	13.0	13.1	14.4	13.5
Yankton, S. Dak.....	7.2	7.0	7.0	6.5	5.9	5.6	5.8	5.8	6.5	8.6	10.4	10.8	12.0	12.6	12.2	11.9	10.9	10.8	9.4	7.6	7.2	7.2	6.6	7.0	8.4
West Indies.																									
Basseterre, St. Kitts .	9.9	10.1	9.9	9.7	8.9	9.2	10.2	11.0	11.8	12.2	12.4	12.5	12.0	11.6	10.9	11.0	10.4	9.5	9.5	9.8	10.1	10.8	10.6	10.3	10.6
Bridgetown, Bar.....	4.7	4.9	5.2	4.6	4.9	4.5	6.7	9.2	9.9	10.7	11.1	11.2	10.9	10.7	9.8	8.4	6.7	5.3	5.2	5.3	5.3	4.9	4.5	4.5	7.0
Cienfuegos, Cuba	4.5	4.9	4.6	4.6	4.3	4.1	4.0	4.2	4.0	5.0	5.2	5.9	6.4	6.8	7.5	8.5	7.4	5.7	5.2	4.8	4.5	4.3	4.5	4.7	5.2
Havana, Cuba.....	4.1	3.7	3.0	2.8	2.8	3.0	3.3	3.3	4.4	6.5	8.3	9.8	11.8	12.8	13.3	11.1	10.2	9.3	8.0	7.4	6.9	5.1	4.1	3.6	6.6
Kingston, Jamaica...	4.3	4.7	4.5	4.6	4.5	4.9	4.6	3.5	2.9	4.5	7.2	10.1	12.4	12.0	10.3	7.9	6.8	5.6	4.1	3.8	4.1	4.2	4.4	4.5	5.9
Port of Spain, Trin...	2.3	2.0	2.1	1.8	2.1	1.7	2.6	5.4	6.3	6.7	6.9	6.7	6.5	6.6	6.0	6.5	6.0	5.0	4.3	3.1	3.0	2.7	2.5	2.5	4.2
Puerto Principe, Cuba	2.8	2.6	2.8	2.3	2.6	2.4	2.7	4.8	7.3	7.0	7.2	7.0	7.2	7.7	8.5	9.7	9.7	7.7	5.6	4.7	4.3	3.6	3.8	3.4	5.3
San Juan, Porto Rico.	5.6	5.3	5.2	5.3	5.6	5.5	6.4	6.5	9.0	10.4	10.9	11.8	11.8	12.2	10.7	10.4	9.8	8.1	7.2	7.1	6.5	6.0	6.1	5.9	7.9
Santiago de Cuba....	2.9	2.9	2.7	2.9	2.4	2.3	2.3	3.1	4.4	5.0	5.8	7.0	7.9	7.9	7.4	7.3	5.9	3.9	2.8	3.4	3.0	3.3	2.5	2.8	4.2
Santo Domingo, S. D.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Willemstad, Curaçao.	9.2	8.8	8.7	8.6	8.5	8.5	9.8	12.2	12.8	13.5	13.7	14.3	14.3	14.0	14.2	14.9	14.6	14.0	13.2	12.1	11.2	10.2	10.0	9.4	11.7

TABLE VI.—*Resultant winds from observations at 8 a. m. and 8 p. m., daily, during the month of September, 1899.*

Stations.	Component direction from—				Resultant.	
	N.	S.	E.	W.	Direction from—	Duration.
New England.	*Hours.*	*Hours.*	*Hours.*	*Hours.*	°	*Hours.*
Eastport, Me	14	25	19	21	s. 39 w.	14
Portland, Me	13	21	14	28	s. 60 w.	16
Northfield, Vt	12	42	3	9	s. 11 w.	31
Boston, Mass	13	23	10	27	s. 60 w.	20
Nantucket, Mass	18	18	15	23	w.	8
Woods Hole, Mass	17	19	16	21	s. 68 w.	5
Block Island, R. I	13	20	16	23	s. 45 w.	10
New Haven, Conn	24	18	14	22	n. 53 w.	10
Middle Atlantic States.						
Albany, N. Y	15	37	11	21	s. 40 w.	16
Binghamton, N. Y.†	9	14	3	12	s. 61 w.	10
New York, N. Y	16	18	17	24	s. 74 w.	7
Harrisburg, Pa.†	9	8	10	10	n.	1
Philadelphia, Pa	19	21	16	17	s. 27 w.	2
Atlantic City, N. J	18	23	12	20	s. 58 w.	9
Cape May, N. J	19	23	12	17	s. 51 w.	6
Baltimore, Md	20	20	17	17	.....	.....
Washington, D. C	20	26	14	14	s.	6
Lynchburg, Va	17	23	16	13	s. 45 e.	8
Norfolk, Va	16	23	27	8	s. 70 e.	20
Richmond, Va	22	26	17	8	s. 66 e.	10
South Atlantic States.						
Charlotte, N. C	26	17	27	8	n. 65 e.	21
Hatteras, N. C	33	11	11	12	n. 3 w.	22
Kittyhawk, N. C	25	14	28	11	n. 57 e.	20
Raleigh, N. C	19	16	21	17	n. 53 e.	5
Wilmington, N. C	27	13	23	14	n. 35 e.	16
Charleston, S. C	29	11	24	7	n. 43 e.	25
Augusta, Ga	23	15	20	14	n. 37 e.	10
Savannah, Ga	25	11	26	9	n. 51 e.	22
Jacksonville, Fla	23	16	28	10	n. 69 e.	19
Florida Peninsula.						
Jupiter, Fla	22	17	23	11	n. 67 e.	13
Key West, Fla	23	11	34	9	n. 64 e.	28
Tampa, Fla	25	7	24	10	n. 27 e.	31
Eastern Gulf States.						
Atlanta, Ga	23	10	26	16	n. 38 e.	16
Macon, Ga †	18	6	9	6	n. 14 e.	12
Pensacola, Fla.†	20	1	14	3	n. 30 e.	22
Mobile, Ala	25	9	9	17	n. 17 w.	27
Montgomery, Ala	24	11	15	11	n. 10 e.	23
Meridian, Miss.†	15	4	10	8	n. 10 e.	11
Vicksburg, Miss	26	9	25	9	n. 43 e.	23
New Orleans, La	27	15	19	10	n. 37 e.	15
Western Gulf States.						
Shreveport, La	21	19	27	9	n. 84 e.	18
Fort Smith, Ark	20	10	26	11	n. 56 e.	18
Little Rock, Ark	25	18	19	15	n. 30 e.	8
Corpus Christi, Tex	17	18	33	7	s. 88 e.	26
Fort Worth, Tex†	7	13	7	10	s. 27 w.	7
Galveston, Tex	18	18	29	8	e.	21
Palestine, Tex	31	19	15	1	n. 49 e.	18
San Antonio, Tex	28	16	27	2	n. 64 e.	28
Ohio Valley and Tennessee.						
Chattanooga, Tenn	18	16	12	27	n. 82 w.	15
Knoxville, Tenn	30	9	17	17	n.	21
Memphis, Tenn	30	14	12	19	n. 24 w.	18
Nashville, Tenn	31	10	14	19	n. 13 w.	22
Lexington, Ky.†	9	13	5	11	s. 56 w.	7
Louisville, Ky	25	21	7	19	n. 72 w.	13
Evansville, Ind.†	11	13	6	6	s.	2
Indianapolis, Ind	29	18	10	17	n. 32 w.	13
Cincinnati, Ohio	23	15	17	20	n. 21 w.	8
Columbus, Ohio	23	16	14	21	n. 45 w.	10
Pittsburg, Pa	22	17	15	23	n. 58 w.	9
Parkersburg, W. Va	21	23	16	15	s. 27 e.	2
Elkins, W. Va	13	19	11	23	s. 63 w.	13
Lower Lake Region.						
Buffalo, N. Y	20	14	15	24	n. 56 w.	11
Oswego, N. Y	17	24	10	22	s. 60 w.	14
Rochester, N. Y	16	22	9	29	s. 73 w.	21
Erie, Pa	20	17	13	19	n. 63 w.	7
Cleveland, Ohio	15	18	17	13	s. 53 e.	5
Sandusky, Ohio	20	18	16	18	n. 45 w.	3
Toledo, Ohio	19	16	13	23	n. 73 w.	10
Detroit, Mich	23	16	13	23	n. 53 w.	12
Upper Lake Region.						
Alpena, Mich	30	14	9	23	n. 41 w.	21
Escanaba, Mich	24	15	9	27	n. 63 w.	20
Grand Haven, Mich	29	13	18	14	n. 14 e.	16
Marquette, Mich	26	14	12	25	n. 47 w.	18
Port Huron, Mich	24	16	10	21	n. 54 w.	14
Sault Ste. Marie, Mich	25	13	18	18	n.	8
Chicago, Ill	25	16	18	15	n. 18 e.	10
Milwaukee, Wis	25	15	14	19	n. 24 w.	11
Green Bay, Wis	23	19	15	15	n.	16
Duluth, Minn	31	10	13	21	n. 21 w.	22
North Dakota.						
Moorhead, Minn	25	5	5	15	n. 27 w.	22
Bismarck, N. Dak	30	10	17	21	n. 11 w.	20
Williston, N. Dak	26	17	10	15	n. 29 w.	10
Upper Mississippi Valley.						
St. Paul, Minn	22	22	10	20	w.	10
La Crosse, Wis. †	9	10	11	7	s. 76 e.	4
Davenport, Iowa	26	15	12	22	n. 42 w.	15
Des Moines, Iowa	24	18	18	14	n. 34 e.	7
Dubuque, Iowa	25	19	12	21	n. 56 w.	11
Keokuk, Iowa	20	21	12	22	s. 84 w.	10
Cairo, Ill	24	24	8	16	w.	8
Springfield, Ill	24	15	12	21	n. 45 w.	13
Hannibal, Mo.†	10	9	9	11	n. 63 w.	2
St. Louis, Mo	24	19	10	17	n. 34 w.	9
Missouri Valley.						
Columbia, Mo.*	13	9	9	6	n. 37 e.	5
Kansas City, Mo	20	21	18	14	s. 76 e.	4
Springfield, Mo	23	27	17	8	s. 66 e.	10
Lincoln, Nebr	23	24	18	9	s. 84 e.	9
Omaha, Nebr	22	17	19	11	n. 74 e.	19
Sioux City, Iowa†	13	11	7	5	n. 45 e.	3
Pierre, S. Dak	18	19	26	12	s. 86 e.	14
Huron, S. Dak	20	18	22	16	n. 72 e.	6
Yankton, S. Dak †	10	7	8	13	n. 50 w.	6
Northern Slope.						
Havre, Mont	19	11	12	31	n. 67 w.	21
Miles City, Mont	17	26	16	14	s. 13 e.	9
Helena, Mont	14	21	5	35	s. 77 w.	31
Kalispell, Mont	18	21	15	26	s. 75 w.	11
Rapid City, S. Dak	19	15	15	23	n. 63 w.	9
Cheyenne, Wyo	25	18	10	22	n. 60 w.	14
Lander, Wyo	16	21	13	29	s. 73 w.	17
North Platte, Nebr	19	21	19	13	s. 72 e.	6
Middle Slope.						
Denver, Colo	22	23	17	7	s. 84 e.	10
Pueblo, Colo	20	15	22	20	n. 22 e.	5
Concordia, Kans	11	29	18	10	s. 24 e.	20
Dodge, Kans	16	30	16	8	s. 30 e.	16
Wichita, Kans	22	28	13	7	s. 45 e.	8
Oklahoma, Okla	25	29	12	2	s. 68 e.	11
Southern Slope.						
Abilene, Tex	19	25	26	5	s. 18 e.	6
Amarillo, Tex	13	35	17	5	s. 28 e.	26
Southern Plateau.						
El Paso, Tex	18	10	35	11	n. 72 e.	25
Santa Fe, N. Mex	15	26	25	12	s. 50 e.	17
Flagstaff, Ariz	22	10	20	21	n. 5 w.	12
Phenix, Ariz	16	12	23	23	n.	4
Yuma, Ariz	13	15	18	26	s. 76 w.	8
Independence, Cal	23	16	11	27	n. 66 w.	18
Middle Plateau.						
Carson City, Nev	16	14	11	19	n. 76 w.	8
Winnemucca, Nev	24	17	13	19	n. 41 w.	9
Cedar City, Utah	17	29	16	13	s. 14 e.	12
Salt Lake City, Utah	25	16	18	19	n. 6 w.	9
Grand Junction, Colo	19	15	21	12	n. 27 e.	4
Northern Plateau.						
Baker City, Oreg	20	28	4	14	s. 51 w.	13
Boise, Idaho	12	11	16	31	n. 86 w.	15
Pocatello, Idaho	17	21	7	22	s. 75 w.	16
Spokane, Wash	11	26	22	13	s. 31 e.	18
Walla Walla, Wash	8	30	19	12	s. 18 e.	23
North Pacific Coast Region.						
Fort Canby, Wash	35	15	7	14	n. 19 w.	21
Neah, Wash	6	4	24	29	n. 68 w.	5
Port Crescent, Wash.*	0	1	12	17	s. 79 w.	5
Seattle, Wash	19	20	12	20	s. 83 w.	8
Portland, Oreg	30	15	8	29	n. 35 w.	16
Roseburg, Oreg	33	6	19	19	n.	27
Middle Pacific Coast Region.						
Eureka, Cal	27	14	8	28	n. 57 w.	24
Mount Tamalpais, Cal	32	1	4	35	n. 45 w.	44
Red Bluff, Cal	30	18	17	10	n. 30 e.	14
Sacramento, Cal	16	31	18	10	s. 28 e.	17
San Francisco, Cal	0	18	1	51	s. 70 w.	53
South Pacific Coast Region.						
Fresno, Cal	35	4	8	35	n. 41 w.	41
Los Angeles, Cal	3	21	2	40	s. 65 w.	42
San Diego, Cal	24	16	3	32	n. 75 w.	30
San Luis Obispo, Cal	32	8	4	22	n. 37 w.	30
West Indies.						
Basseterre, St. Kitts Island	14	11	43	2	n. 86 e.	41
Bridgetown, Barbados	8	20	44	2	s. 74 e.	44
Cienfuegos, Cuba	39	3	29	3	n. 36 e.	44
Havana, Cuba	34	7	32	6	n. 45 e.	38
Kingston, Jamaica	44	2	33	3	n. 35 e.	52
Puerto Principe, Cuba	21	8	40	2	n. 71 e.	40
San Juan, Porto Rico	3	25	38	4	s. 57 e.	40
Santiago de Cuba, Cuba	24	17	28	2	n. 75 e.	27
Willemstad, Curaçao	1	5	57	0	s. 86 e.	56

* From observations at 8 p. m. only.

† From observations at 8 a. m. only.

TABLE VII.—*Thunderstorms and auroras, September*, 1899.

States.	No. of stations.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total. No.	Total. Days.	
Alabama	53	T.	1	2	4	1	4	2	2	2	2	1	....	....	....	1	1	....	....	....	....	....	....	....	....	....	....	....	....	..	...	....	....	23	12	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Arizona	53	T.	2	....	2	2	5	4	5	10	3	3	4	..	1	3	1	....	1	....	....	....	....	....	....	....	....	....	....	....	....	1	....	47	15	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Arkansas	57	T.	....	....	....	1	....	....	3	6	2	6	....	....	....	....	....	....	6	....	....	....	....	....	3	2	....	....	....	1	....	....	....	30	9	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
California	189	T.	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Colorado	73	T.	10	3	2	....	1	2	5	3	3	....	....	2	8	8	4	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	53	13	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Connecticut	22	T.	....	1	12	1	....	....	....	4	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	1	3	....	....	....	....	....	23	7	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Delaware	5	T.	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	2	....	....	....	....	....	....	4	3	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Dist. of Columbia	4	T.	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	2	2	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Florida	45	T.	8	3	....	3	3	6	4	2	....	2	7	9	6	7	6	6	4	6	4	7	6	3	1	3	...	1	....	2	1	1	....	111	26	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Georgia	54	T.	3	3	2	1	....	1	2	....	2	7	2	....	1	....	....	....	....	....	....	....	....	....	....	1	5	..	....	....	....	....	....	30	12	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Idaho	37	T.	....	4	....	1	1	..	....	1	....	....	....	2	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	10	6	T.
		A.	....	1	....	....	....	....	....	....	....	....	....	..	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	A.
Illinois	92	T.	1	....	....	....	2	9	17	11	....	2	....	....	....	....	....	1	7	2	....	....	....	6	1	11	2	...	2	7	1	....	....	82	16	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	2	....	....	....	....	....	4	2	A.
Indiana	55	T.	4	....	3	....	1	11	12	12	....	....	1	....	....	....	....	....	3	1	....	....	....	....	....	10	1	....	....	....	....	....	....	59	11	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Indian Territory	8	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	1	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Iowa	126	T.	2	....	....	1	4	6	20	4	....	6	....	....	....	3	4	7	1	1	....	....	3	17	1	8	1	1	1	2	....	....	....	93	20	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	4	1	1	....	....	..	8	4	A.
Kansas	74	T.	....	....	....	....	....	....	14	6	3	1	1	....	....	....	1	8	1	....	1	....	1	9	....	....	....	....	....	1	....	....	....	47	12	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Kentucky	45	T.	....	1	....	....	1	2	4	5	1	1	....	....	....	....	....	....	....	....	1	1	....	....	....	2	3	1	....	....	....	....	....	23	12	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Louisiana	45	T.	8	6	2	4	4	5	7	4	7	3	4	2	....	....	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	60	13	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Maine	17	T.	....	....	9	....	1	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	2	....	14	5	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	1	....	2	2	A.
Maryland	39	T.	3	11	1	....	....	1	2	12	3	....	1	....	....	....	....	....	....	....	2	1	1	....	2	....	22	3	....	....	....	....	....	65	14	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Massachusetts	54	T.	1	....	22	....	....	....	1	10	....	....	....	....	....	....	....	....	....	....	....	....	3	1	....	....	3	....	....	....	....	....	....	41	6	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	A.
Michigan	107	T.	3	....	....	5	26	13	15	2	...	3	...	..	....	....	....	4	7	4	...	....	....	....	....	20	1	...	....	1	....	....	....	104	13	T.
		A.	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	7	....	....	....	....	....	10	3	A.
Minnesota	64	T.	4	8	6	10	6	12	6	....	....	8	....	....	....	4	6	3	....	....	....	....	1	2	....	2	....	....	....	....	....	....	....	78	14	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	7	4	1	....	....	....	....	13	4	A.
Mississippi	42	T.	4	1	5	4	5	3	6	2	5	3	1	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	42	12	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Missouri	89	T.	....	....	1	....	1	1	14	9	....	5	....	....	....	....	....	14	9	2	1	....	....	10	1	1	....	....	1	6	....	....	....	76	15	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	1	1	A.
Montana	37	T.	2	1	4	1	1	....	....	....	....	....	....	4	7	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	20	7	T.
		A.	....	2	....	....	....	....	....	....	....	1	....	....	....	....	1	....	....	....	....	....	....	....	....	....	2	2	1	....	....	....	....	9	6	A.
Nebraska	145	T.	....	....	2	1	....	3	22	1	....	....	....	1	2	2	1	....	....	....	....	....	....	10	....	....	....	....	....	....	....	....	....	45	10	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	2	1	A.
Nevada	45	T.	4	1	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	7	4	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
New Hampshire	20	T.	....	....	4	...	....	....	1	4	....	....	1	1	1	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	13	7	T.
		A.	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	1	....	....	....	....	....	3	3	A.
New Jersey	50	T.	....	5	14	4	....	....	1	20	2	....	....	....	....	....	....	....	....	....	....	....	....	....	2	7	12	....	..	8	....	....	....	75	10	T.
		A.	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	A.
New Mexico	38	T.	....	4	4	....	3	2	3	2	1	1	....	....	....	2	4	2	....	1	1	....	....	....	....	....	....	....	....	....	....	2	....	32	14	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
New York	103	T.	9	4	23	....	....	....	5	13	1	....	....	1	1	....	....	....	....	....	1	....	....	1	....	....	19	8	....	....	15	1	....	102	14	T.
		A.	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	A.
North Carolina	56	T.	1	6	4	4	1	7	10	12	12	2	2	....	....	....	....	....	....	....	1	1	1	....	....	....	9	1	....	....	....	....	....	74	16	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
North Dakota	40	T.	....	....	5	2	....	....	..	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	9	3	T
		A.	....	....	2	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	1	2	2	....	....	....	....	9	6	A
Ohio	124	T.	15	1	6	1	12	11	18	12	2	....	....	....	....	...	1	...	....	6	4	....	....	....	....	13	4	....	....	1	....	....	....	107	15	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Oklahoma	22	T.	....	....	....	....	....	....	2	3	5	1	....	....	....	....	....	1	2	....	....	....	3	....	....	....	..	....	....	1	....	....	..	18	8	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Oregon	71	T.	....	2	3	4	1	....	....	....	....	....	2	2	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	15	7	T.
		A.	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	A.
Pennsylvania	100	T.	16	7	11	....	3	6	2	27	7	1	2	2	....	....	....	....	....	....	2	1	1	1	3	2	22	6	2	1	4	....	....	129	22	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	..	....	....	2	1	A.
Rhode Island	8	T.	....	....	2	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	4	3	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
South Carolina	44	T.	5	3	6	2	1	2	13	2	4	2	3	....	....	....	....	1	....	....	1	4	....	....	....	....	6	....	....	....	....	....	....	55	15	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
South Dakota	52	T.	....	1	2	4	4	5	....	....	....	....	....	....	1	1	5	5	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	29	10	T.
		A.	....	1	....	....	....	....	1	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	1	....	....	....	....	....	7	5	A.
Tennessee	61	T.	....	1	2	1	4	8	11	7	2	4	4	....	....	....	1	....	....	1	2	....	....	....	....	....	11	1	....	1	1	....	....	62	17	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Texas	83	T.	2	1	2	....	....	1	2	6	4	5	2	3	....	....	..	1	6	..	....	....	....	....	....	....	....	....	....	....	....	....	....	35	12	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Utah	34	T.	2	1	....	....	....	....	....	....	....	....	....	....	2	1	4	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	11	6	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Vermont	14	T.	....	....	6	....	....	....	....	3	...	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	1	....	..	1	....	....	13	6	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Virginia	47	T.	1	5	3	....	2	9	10	10	4	2	...	....	....	....	....	....	....	....	2	1	1	....	....	1	13	2	....	....	....	....	....	66	15	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Washington	55	T.	3	....	1	8	4	....	....	....	....	....	1	2	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	....	23	8	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
West Virginia	38	T.	8	6	3	1	2	2	12	11	2	1	....	....	1	....	....	....	....	1	....	....	....	....	1	3	....	....	....	....	....	....	....	54	14	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Wisconsin	60	T.	....	5	....	5	16	17	7	....	....	10	1	....	....	....	1	7	1	....	....	....	....	....	3	2	....	....	....	1	....	....	....	76	13	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	4	6	....	....	....	....	....	12	4	A.
Wyoming	18	T.	....	3	....	....	....	....	....	....	....	....	1	....	1	3	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	9	5	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	1	1	A.
Sums	2,804	T.	122	101	178	72	119	151	238	241	79	80	42	31	34	36	48	61	51	25	25	20	19	59	16	81	139	43	6	25	31	10	....	2,203	....	T.
		A	1	6	0	0	0	1	2	2	0	3	0	0	1	0	1	0	0	1	0	0	0	0	2	1	27	32	5	2	0	1	....	88	....	A.

TABLE VIII.—*Average hourly sunshine (in percentages), September, 1899.*

Stations.	Instrument.	Percentages for each hour of local mean time ending with the respective hour.																Hours of sunshine.			
		A. M.								P. M.								Total.			Personal estimate.
		5	6	7	8	9	10	11	Noon	1	2	3	4	5	6	7	8	Actual.	Possible.	Percent of possible.	
																		Hours.	*Hours.*		
Albany, N. Y	T.	.....	36	40	53	67	72	82	77	78	73	65	58	52	46	43	.....	234.4	375.0	63	43
Atlanta, Ga	T.	.....	75	73	79	88	88	93	89	89	87	81	72	68	63	66	.....	300.0	371.8	81	71
Atlantic City, N. J	P.	.....	64	70	67	70	75	82	80	81	86	83	82	84	73	73	.....	288.9	373.4	77	65
Baltimore, Md	T.	.....	61	57	68	77	84	88	86	85	83	84	82	74	54	65	.....	285.3	373.4	76	65
Binghamton, N. Y	T.	.....	19	24	32	42	48	49	46	40	32	32	30	31	40	47	.....	138.3	374.5	37	32
Bismarck, N. Dak	P.	.....	53	55	69	78	86	85	83	76	87	82	83	78	74	83	.....	291.7	376.9	77	73
Boise, Idaho	P.	.....	86	84	90	97	99	99	97	92	94	91	93	90	85	92	.....	342.0	375.4	92	82
Boston, Mass	T.	.....	45	40	50	55	68	72	69	67	66	62	55	55	40	31	.....	215.6	374.5	58	60
Buffalo, N. Y	T.	.....	28	27	44	54	65	71	71	75	73	74	61	42	33	27	.....	211.2	375.0	56	32
Cedar City, Utah	T.	.....	78	77	90	92	98	100	100	100	97	93	92	92	85	92	.....	345.0	373.0	92	82
Charleston, S. C	T.	.....	38	37	47	68	72	66	72	71	69	74	72	49	49	44	.....	227.7	371.4	61	60
Chattanooga, Tenn	T.	.....	71	69	75	87	93	95	98	93	93	89	79	73	65	69	.....	311.5	372.0	84	71
Cheyenne, Wyo	P.	.....	73	74	79	82	89	87	85	86	85	79	73	70	51	33	.....	290.4	374.0	78	63
Chicago, Ill	T.	.....	40	37	42	55	61	59	64	66	64	67	66	44	25	36	.....	200.7	374.5	54	46
Cincinnati, Ohio	T.	.....	82	73	74	79	85	87	90	89	89	83	71	64	52	62	.....	290.9	373.4	78	64
Cleveland, Ohio	T.	.....	34	30	35	40	43	46	52	57	55	55	50	38	28	42	.....	164.5	374.5	44	45
Columbia, Mo	T.	.....	76	79	85	87	92	93	92	93	93	90	84	82	66	65	.....	320.4	373.4	86	65
Columbus, Ohio	T.	.....	30	27	28	30	43	53	64	63	68	65	56	52	45	54	.....	183.7	373.6	49	56
Denver, Colo	P.	.....	72	78	85	87	87	89	90	87	82	81	79	71	53	34	.....	298.7	373.6	80	76
Des Moines, Iowa	T.	.....	52	60	57	57	72	75	76	77	75	68	66	58	56	64	.....	247.4	374.5	66	57
Detroit, Mich	T.	.....	35	41	53	55	66	62	73	70	69	62	59	54	34	32	.....	212.3	374.5	57	42
Dodge, Kans	P.	.....	57	64	72	79	83	82	80	80	88	83	82	78	77	72	.....	292.2	373.0	78	68
Dubuque, Iowa	T.	.....	60	55	67	76	80	82	79	80	82	76	76	55	50	46	.....	265.8	374.5	71	54
Eastport, Me	P.	.....	28	31	41	52	58	55	60	60	63	67	62	54	49	43	.....	201.8	375.8	54	35
Elkins, W. Va	T.	.....	5	10	15	52	71	71	72	69	65	57	53	36	24	7	.....	178.7	373.4	48	45
Erie, Pa	T.	.....	20	21	25	40	43	49	60	54	54	59	62	53	58	73	.....	179.0	374.5	48	35
Escanaba, Mich	T.	.....	21	23	17	23	37	40	42	47	40	34	23	16	16	7	.....	110.3	376.1	29	29
Eureka, Cal	P.	.....	19	13	17	23	21	37	46	51	58	57	55	47	42	52	.....	144.9	374.0	39	33
Fresno, Cal	T.	.....	93	88	89	97	99	98	100	100	100	98	98	89	85	100	.....	353.4	372.6	95	92
Galveston, Tex	P.	.....	26	33	73	82	80	81	79	87	87	84	84	77	33	16	.....	266.2	370.4	72	66
Grand Junction, Colo	P.	.....	97	93	94	90	92	91	93	94	92	89	95	83	92	98	.....	342.2	373.4	92	77
Harrisburg, Pa	T.	.....	45	49	49	63	73	75	81	81	73	69	60	53	46	36	.....	237.3	373.6	64	54
Helena, Mont	P.	.....	50	54	70	76	78	80	78	83	83	90	91	84	78	72	.....	293.4	376.9	78	60
Huron, S. Dak	T.	.....	77	70	73	64	71	74	82	76	72	65	65	63	67	71	.....	264.1	375.4	70	59
Indianapolis, Ind	T.	.....	52	50	56	74	77	77	75	73	67	62	55	42	28	32	.....	226.9	373.6	61	49
Jacksonville, Fla	T.	.....	14	21	39	58	70	68	68	70	71	68	54	45	33	29	.....	201.3	370.8	54	54
Kalispell, Mont	T.	.....	39	48	67	78	81	87	84	86	88	87	81	77	58	47	.....	284.1	377.5	75	59
Kansas City, Mo	P.	.....	75	73	72	76	78	83	77	78	76	82	79	79	71	80	.....	287.5	373.4	77	74
Key West, Fla	T.	.....	18	23	54	63	76	74	78	74	67	65	68	54	31	41	.....	220.0	369.0	60	46
Knoxville, Tenn	T.	.....	67	67	73	79	84	90	90	88	91	78	70	64	47	40	.....	283.3	372.2	76	60
Lexington, Ky	T.	.....	62	61	74	82	85	88	89	93	90	89	85	64	47	40	.....	292.0	373.0	78	58
Little Rock, Ark	T.	.....	79	77	85	91	94	95	95	93	89	81	78	73	69	71	.....	315.3	372.0	85	74
Los Angeles, Cal	P.	.....	40	37	51	59	81	94	92	96	96	93	90	85	67	81	.....	288.7	371.8	78	72
Louisville, Ky	T.	.....	65	60	64	75	88	88	82	77	78	75	76	61	57	75	.....	274.0	373.0	73	68
Macon, Ga	T.	.....	41	58	85	90	95	97	96	95	96	93	89	80	60	38	.....	314.8	371.4	85	66
Meridian, Miss	T.	.....	83	83	84	94	97	95	90	90	86	80	77	71	65	50	.....	311.8	371.4	84	79
Minneapolis, Minn	T.	.....	40	38	54	62	67	65	73	72	72	72	72	63	46	32	25	.....	219.9	375.8	59	.....
Mount Tamalpais, Cal	P.	.....	96	94	88	96	98	98	100	98	98	97	96	94	85	85	.....	354.7	373.0	95	80
Nashville, Tenn	T.	.....	72	70	76	79	81	86	87	82	79	78	71	61	36	38	.....	278.3	372.2	73	76
New Orleans, La	T.	.....	87	80	89	94	97	98	98	98	94	88	90	76	65	63	.....	329.0	370.8	89	80
New York, N. Y	T.	.....	42	43	53	64	71	75	72	76	75	74	70	58	37	33	.....	235.6	374.0	63	56
Northfield, Vt	P.	.....	38	38	47	50	56	57	50	46	48	53	46	40	30	29	.....	173.2	375.4	46	38
Oklahoma, Okla	T.	.....	77	76	85	94	94	92	94	96	95	92	92	86	78	77	.....	331.6	372.0	89	83
Omaha, Nebr	P.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	55
Parkersburg, W. Va	T.	.....	46	43	44	51	53	67	72	69	68	58	52	31	27	20	.....	195.3	373.4	52	52
Phenix, Ariz	P.	.....	77	70	79	89	90	90	90	97	97	94	86	83	75	89	.....	321.6	371.4	87	79
Philadelphia, Pa	T.	.....	56	60	64	71	83	91	95	90	85	85	81	75	72	73	.....	294.3	373.6	79	59
Pittsburg, Pa	T.	.....	48	47	48	57	61	63	74	67	62	60	59	52	51	64	.....	218.1	374.0	58	53
Pocatello, Idaho	T.	.....	75	70	77	94	98	96	97	99	97	98	97	87	82	87	.....	339.5	375.0	91	76
Portland, Me	T.	.....	21	25	55	68	76	77	76	78	73	61	56	45	34	21	.....	220.8	375.4	59	49
Portland, Oreg	T.	.....	23	28	42	53	59	66	68	71	74	73	77	67	58	43	.....	225.4	376.1	60	67
Raleigh, N. C	T.	.....	62	62	76	90	96	95	91	95	94	93	94	82	53	40	.....	312.8	372.2	84	77
Rochester, N. Y	T.	.....	17	29	40	59	66	69	74	81	71	70	68	47	44	38	.....	219.1	375.0	58	49
St. Louis, Mo	T.	.....	75	65	76	84	91	91	93	91	88	87	83	79	64	62	.....	306.9	373.4	82	71
St. Paul, Minn	P.	.....	46	44	64	66	70	72	68	66	71	72	65	53	43	18	.....	231.5	375.8	62	53
Salt Lake City, Utah	P.	.....	79	76	90	93	94	95	98	99	94	98	94	92	75	76	.....	340.4	374.0	91	87
San Diego, Cal	P.	.....	21	19	28	50	65	80	88	90	91	91	89	87	81	87	.....	262.4	371.4	71	83
San Francisco, Cal	T.	.....	23	19	38	70	90	96	100	100	100	100	100	90	58	60	.....	292.5	373.0	78	70
Santa Fe, N. Mex	P.	.....	88	90	90	92	87	88	86	85	82	85	76	76	72	62	.....	312.0	372.2	84	74
Savannah, Ga	T.	.....	72	66	79	89	90	91	95	93	84	82	84	82	66	59	.....	308.3	371.4	83	72
Seattle, Wash	T.	.....	19	24	36	38	52	60	76	74	75	67	63	56	54	45	.....	208.5	377.5	55	57
Spokane, Wash	T.	.....	68	70	68	74	82	78	81	80	78	74	70	57	58	52	.....	272.4	377.5	72	62
Tacoma, Wash	T.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Tampa, Fla	T.	.....	66	64	72	74	78	87	81	77	64	49	43	33	20	6	.....	227.8	369.6	62	38
Topeka, Kans.*	T.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Vicksburg, Miss	T.	.....	76	77	67	73	94	91	87	84	83	85	86	77	69	50	.....	299.2	371.4	81	76
Washington, D. C	P.	.....	65	67	71	73	78	84	77	81	76	76	83	71	71	78	.....	281.7	373.4	75	69
Wilmington, N. C	T.	.....	39	36	59	68	73	81	87	85	80	77	71	65	47	49	.....	253.4	371.8	68	63
Yankton, S. Dak	T.	.....	32	45	63	74	79	79	80	86	84	80	70	57	35	37	.....	254.6	375.0	68	58
Basseterre, St. Kitts	T.	.....	48	63	86	90	88	89	87	88	87	87	84	76	56	43	.....	297.3	367.1	81	38
Bridgetown, Barbados	T.	.....	7	51	69	72	71	72	75	74	74	70	48	25	20	7	.....	216.8	366.0	59	34
Cienfuegos, Cuba	T.	.....	55	53	57	71	84	86	87	83	87	62	41	21	17	28	.....	229.0	368.0	62	62
Havana, Cuba	T.	.....	63	63	58	73	75	76	73	71	72	42	31	20	17	21	.....	206.6	368.5	56	56
Kingston, Jamaica, W. I	T.	.....	16	17	48	78	86	86	81	75	49	37	36	18	0	0	.....	184.2	367.2	50	39
Port of Spain, Trinidad, W. I	T.	.....	46	46	62	78	85	87	77	68	67	61	51	56	29	33	.....	232.9	365.6	64	53
Puerto Principe, Cuba	T.	.....	75	74	81	86	84	92	89	79	76	57	42	23	17	12	.....	245.2	367.8	67	56
Roseau, Dominica, W. I	T.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
San Juan, Porto Rico	T	.....	5	34	73	84	90	87	88	82	80	83	73	63	30	0	.....	260.2	367.2	71	54
Santiago de Cuba, Cuba	T.	.....	91	86	78	89	86	89	86	74	89	86	67	31	17	0	.....	269.0	367.6	73	48
Santo Domingo, Santo Domingo	T.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Willemstad, Curaçao	T.	.....	7	7	34	61	67	76	82	85	84	91	90	76	55	43	.....	249.3	365.7	67	52

*Incomplete.

TABLE IX.—*Accumulated amounts of precipitation for each 5 minutes, for storms in which the rate of fall equaled or exceeded 0.25 in any 5 minutes, or 0.75 in 1 hour during September, 1899, at all stations furnished with self-registering gages.*

Stations.	Date.	Total duration.		Total am't of precipitation.	Excessive rate.		Amount before excessive began.	Depths of precipitation (in inches) during periods of time as indicated.													
		From—	To—		Began—	Ended—		5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Albany, N. Y.	29-30			1.36														0.62			
Atlanta, Ga.	10	9.14 p.m.	11.40 p.m.	1.90	9.14 p.m.	10.15 p.m.	0.00	0.39	0.61	0.68	0.76	0.84	0.89	1.01	1.07	1.12	1.17	1.47	1.58		
Atlantic City, N. J.	11	10.36 a.m.	4.20 p.m.	3.52	12.35 p.m.	1.40 p.m.	0.42	0.13	0.43	0.71	0.84	1.03	1.21	1.38	1.58	1.78	1.98	2.37	2.52	2.72	2.84
	19-20	9.23 p.m.	7.30 a.m.	3.24	10.37 p.m.	12.15 a.m.	0.15	0.06	0.11	0.16	0.21	0.27	0.32	0.36	0.41	0.46	0.51	0.61	1.01	1.25	
Baltimore, Md.	25	5.20 p.m.	8.05 p.m.	2.15	5.42 p.m.	6.20 p.m.	0.11	0.09	0.21	0.28	0.40	0.53	0.75	0.87	0.90	0.92					
Binghamton, N. Y.	25			0.28													0.28				
Bismarck, N. Dak.	16			0.04																	
Boise, Idaho	2-3			0.28														*			
Boston, Mass.	20	4.00 a.m.	12.30 p.m.	2.82	7.20 a.m.	9.20 a.m.	0.67	0.07	0.15	0.28	0.30	0.35	0.39	0.48	0.57	0.61	0.65	0.70	0.94	1.19	1.63
Buffalo, N. Y.	18-19			1.39														0.44			
Cairo, Ill.	10	4.00 p.m.	6.10 p.m.	0.74	4.03 p.m.	4.27 p.m.	T.	0.22	0.39	0.55	0.61	0.65									
Charleston, S. C.	18			0.55														0.43			
Cincinnati, Ohio	6	8.12 p.m.	10.15 p.m.	1.22	8.20 p.m.	9.35 p.m.	0.03	0.06	0.11	0.17	0.34	0.41	0.55	0.60	0.64	0.70	0.73	0.83	1.13	1.18	
Cleveland, Ohio	18-19			0.43												0.17					
Columbia, Mo.	17			2.44														0.36			
Columbus, Ohio	1			0.50														0.47			
Denver, Colo.	16			0.20														0.11			
Des Moines, Iowa	24			0.75														*			
Detroit, Mich.	18			1.06														0.34			
Dodge, Kans.	8-9			1.02														0.15			
Duluth, Minn.	6			1.39														0.42			
Eastport, Me.	20			1.35														0.25			
Elkins, W. Va.	8	5.55 p.m.	7.20 p.m.	0.66	6.05 p.m.	6.20 p.m.	0.02	0.16	0.29	0.57	0.59	0.63									
Erie, Pa.	18-19			0.79											0.46						
Escanaba, Mich.	7	12.50 a.m.	D. N.	1.68	12.50 a.m.	1.20 a.m.	0.00	0.09	0.30	0.41	0.47	0.57	0.69	0.70	0.73	0.78					
Fort Worth, Tex.	17			1.02														0.68			
Fresno, Cal. †																					
Galveston, Tex.	2	D. N.	10.02 a.m.	1.71	7.25 a.m.	7.40 a.m.	0.87	0.35	0.64	0.74	0.76										
Grand Junction, Colo.	14			0.29														0.29			
Hannibal, Mo.	17	12.15 a.m.	6.00 a.m.	0.95	12.20 a.m.	12.40 a.m.	0.03	0.05	0.36	0.51	0.58										
Harrisburg, Pa.	8	6.04 p.m.	7.15 p.m.	0.62	6.10 p.m.	6.20 p.m.	T.	0.18	0.27	0.42											
Hatteras, N. C.	10-11			0.32														0.21			
Huron, S. Dak.	15-17			0.16														0.09			
Indianapolis, Ind.	7			0.76													0.76				
Jacksonville, Fla.	16-17	D. N.	D. N.	1.72	2.55 a.m.	3.20 a.m.	0.96	0.20	0.45	0.59	0.71	0.75									
Jupiter, Fla.	15	D. N.	9.15 a.m.	2.74	5.58 a.m.	7.15 a.m.	0.08	0.07	0.24	0.62	0.90	1.16	1.38	1.63	1.78	1.90	2.11	2.42	2.56		
	30	D. N.	7.58 a.m.	2.51	6.05 a.m.	6.58 a.m.	0.60	0.47	0.72	0.82	0.90	0.99	1.06	1.15	1.22	1.32	1.57	1.65	1.79		
Kalispell, Mont.	12-13			1.22						0.37											
Kansas City, Mo.	9-10			0.69														0.48			
Key West, Fla.	6			0.37														0.36			
Knoxville, Tenn.	25			0.60														0.31			
Lexington, Ky.	25			0.77														0.33			
Lincoln, Nebr.	7			0.32														0.28			
Little Rock, Ark.	10	1.33 p.m.	4.30 p.m.	1.37	1.40 p.m.	2.25 p.m.	0.10	0.25	0.41	0.66	0.79	0.86	1.01	1.06	1.11	1.21	1.24				
	17-18	7.00 p.m.	D. N.	1.47	11.23 p.m.	11.38 p.m.	0.42	0.19	0.35	0.59	0.62										
Los Angeles, Cal.	9			T.																	
Louisville, Ky.	8			0.38											0.37						
Macon, Ga.	10	3.24 p.m.	4.42 p.m.	1.41	3.33 p.m.	4.00 p.m.	T.	0.33	0.61	0.89	1.04	1.19	1.28	1.35	1.38						
Memphis, Tenn.	10			0.24									0.24								
Meridian, Miss.	19			0.27														0.22			
Milwaukee, Wis.	24			1.57														0.32			
Montgomery, Ala.	19			0.30														0.30			
Nantucket, Mass.	10-11			1.50														*			
Nashville, Tenn.	6			0.36										0.36							
New Orleans, La.	15			0.19					0.19												
New York, N. Y.	2	3.50 a.m.	11.32 a.m.	2.39	6.50 a.m.	7.40 a.m.	0.40	0.11	0.19	0.24	0.26	0.28	0.36	0.50	0.55	0.61	0.65				
					7.40 a.m.	9.00 a.m.		0.69	0.70	0.70	0.70	0.73	0.77	0.84	0.94	1.08	1.18	1.36	1.63	1.73	1.80
Norfolk, Va.	10			0.14														0.13			
Northfield, Vt.	1-2			1.69														0.37			
Oklahoma, Okla.	16-17			0.69														0.24			
Omaha, Nebr.	7			0.30														0.18			
Parkersburg, W. Va.	10-11	11.25 p.m.	6.50 a.m.	1.54	12.55 a.m.	1.45 a.m.	0.36	0.11	0.18	0.33	0.44	0.56	0.64	0.71	0.77	0.81	0.85	0.89	0.97	1.05	1.08
Philadelphia, Pa.	19	3.57 p.m.	6.45 p.m.	0.81	3.57 p.m.	4.10 p.m.	0.00	0.27	0.42	0.46	0.47										
	26	12.05 a.m.	7.54 a.m.	1.06	12.57 a.m.	1.27 a.m.	T.	0.14	0.25	0.44	0.46	0.57	0.71								
Pittsburg, Pa.	1	2.25 p.m.	4.55 p.m.	0.65	2.35 p.m.	2.53 p.m.	0.04	0.17	0.42	0.55	0.60	0.61									
Pocatello, Idaho	2			T.																	
Portland, Me.	30			1.88														0.39			
Portland, Oreg.	29			0.18														0.17			
Raleigh, N. C.	25-26	8.30 p.m.	D. N.	1.26	8.32 p.m.	8.55 p.m.	T.	0.22	0.39	0.50	0.61	0.64									
Richmond, Va.	6	6.00 p.m.	8.20 p.m.	0.96	6.05 p.m.	6.23 p.m.	T.	0.09	0.39	0.71	0.82										
	19-20	2.05 p.m.	D. N.	2.33	5.00 p.m.	7.00 p.m.	0.50	0.13	0.16	0.20	0.29	0.37	0.45	0.51	0.58	0.66	0.73	0.79	1.16	1.44	1.61
Rochester, N. Y.	25-26			1.16														0.10			
St. Louis, Mo.	17			0.84														0.62			
St. Paul, Minn.	6			0.35					0.35												
Salt Lake City, Utah.	13			T.																	
San Diego, Cal. †																					
San Francisco, Cal. †																					
Savannah, Ga.	17	5.30 a.m.	11.35 p.m.	3.51	8.40 p.m.	9.25 p.m.	2.34	0.11	0.21	0.28	0.47	0.58	0.59	0.67	0.68	0.77	0.79				
Seattle, Wash.	12	10.12 p.m.	11.20 p.m.	0.69	10.15 p.m.	10.55 p.m.	T.	0.08	0.16	0.29	0.35	0.46	0.57	0.57	0.61	0.63					
Spokane, Wash.	13			0.33														0.18			
Tampa, Fla.	6	4.19 p.m.	8.30 p.m.	1.86	5.00 p.m.	5.45 p.m.	0.30	0.18	0.40	0.70	0.90	1.05	1.15	1.25	1.30	1.40					
	11	3.32 p.m.	5.00 p.m.	1.30	3.37 p.m.	4.20 p.m.	0.05	0.15	0.45	0.50	0.57	0.62	0.73	0.99	1.14						
	18	9.15 a.m.	5.35 p.m.	1.22	2.05 p.m.	2.25 p.m.	0.45	0.05	0.19	0.40	0.45										
Vicksburg	7	11.55 a.m.	2.00 p.m.	1.02	1.10 p.m.	1.40 p.m.	0.19	0.08	0.29	0.41	0.60	0.72	0.80	0.82							
Washington, D. C.	25	12.45 p.m.	2.30 p.m.	0.61	1.05 p.m.	1.20 p.m.	0.01	0.07	0.21	0.38	0.49	0.54									
	25-26	5.03 p.m.	7.50 a.m.	2.10	8.30 p.m.	9.00 p.m.	0.52	0.03	0.06	0.26	0.78	0.82	0.84	0.87	0.89						
Wilmington, N. C.	18			0.06				0.06													
Yankton, S. Dak.	5			0.01																	
Basseterre, St. Kitts	28	10.55 a.m.	11.40 a.m.	0.67	10.55 a.m.	11.20 a.m.	0.00	0.09	0.27	0.40	0.55	0.62	0.64	0.66							
Bridgetown, Barbados	13	9.50 a.m.	11.40 a.m.	3.73	9.50 a.m.	11.30 a.m.	0.00	0.15	0.40	0.47	0.59	0.78	1.08	1.59	2.03	2.45	2.76	3.17	3.50	3.72	
Cienfuegos, Cuba	10	1.25 p.m.	2.25 p.m.	0.82	1.42 p.m.	2.10 p.m.	T.	0.11	0.26	0.39	0.62	0.73	0.82								
	22	5.20 p.m.	7.30 p.m.	0.82	6.20 p.m.	6.40 p.m.	0.16	0.21	0.40	0.57	0.63										
	23	5.20 p.m.	D. N.	1.85	5.34 p.m.	6.14 p.m.	T.	0.11	0.25	0.50	0.79	1.11	1.29	1.46	1.56						
Havana, Cuba	5	1.16 p.m.	2.00 p.m.	0.99	1.25 p.m.	1.45 p.m.	T.	0.18	0.54	0.82	0.99										
Kingston, Jamaica	2	1.35 p.m.	2.58 p.m.	1.63	1.50 p.m.	2.25 p.m.	T.	0.18	0.56	1.01	1.17	1.36	1.49	1.58	1.61						
Port of Spain, Trin.	17	11.10 a.m.	11.55 a.m.	0.60	11.14 a.m.	11.30 a.m.	T.	0.25	0.46	0.54	0.57	0.59									
	21	11.35 a.m.	12.55 p.m.	0.96	12.05 p.m.	12.30 p.m.	0.10	0.08	0.30	0.47	0.65	0.79	0.80								
Puerto Principe, Cuba	17	3.10 p.m.	5.23 p.m.	2.72	3.10 p.m.	3.50 p.m.	0.00	0.29	0.98	1.50	1.89	2.16	2.42	2.60	2.68	2.71	2.72				
San Juan, Porto Rico	1	10.03 a.m.	4.30 p.m.	2.69	2.20 p.m.	4.02 p.m.	0.92	0.07	0.16	0.26	0.30	0.33	0.41	0.55	0.65	0.66	0.69	0.82	1.27	1.63	1.77
Do	9	12.34 p.m.	1.08 p.m.	0.65	12.35 p.m.	12.55 p.m.	T.	0.20	0.32	0.41	0.62	0.65									
Do	24	9.07 p.m.	D. N.	1.15	9.10 p.m.	10.15 p.m.	0.01	0.10	0.16	0.20	0.28	0.41	0.47	0.50	0.57	0.74	0.81	0.89	1.04		

TABLE IX.—*Accumulated amounts of precipitation for each 5 minutes, etc.*—Continued.

Stations.	Date.	Total duration.		Total am't of precipitation.	Excessive rate.		Amount before excessive began.	Depths of precipitation (in inches) during periods of time as indicated.													
		From—	To—		Began—	Ended—		5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
San Juan, Porto Rico	30	11.31 a. m.	3.50 p. m.	2.22	11.53 a. m.	1.00 p. m.	0.03	0.13	0.25	0.31	0.35	0.44	0.56	0.75	0.91	0.96	1.06	1.43	1.49	1.59	1.95
Santiago de Cuba	11	7.35 p. m.	8.34 p. m	0.71	7.40 p. m.	8.15 p. m.	0.02	0.05	0.08	0.19	0.26	0.42	0.55	0.63	0.66	0.69	.....	.....	.....	.....	.....
	28	3.02 p. m.	3.30 p. m.	0.63	3.03 p. m.	3.17 p. m.	T.	0.10	0.36	0.63	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Santo Domingo, W. I.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Willemstad, Curaçao	2	.....	.....	0.43	.....	.....	.....	.....	.....	.....	.....	0.43	.....	.....	.....	.....	.....	.....	.....	.....	.....

*Self-register out of order. †No precipation during the month.

TABLE X.—*Excessive precipitation, by stations, for September*, 1899.

Stations.	Monthly rainfall 10 inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
Alabama.	*Inches.*	*Inches.*		*Ins.*	*h.m.*	
Oneonto				2.02	0 25	9
Arizona.						
Bisbee				2.41	1 00	6
Silver King		2.50	8			
Arkansas						
Hot Springs				1.50	1 00	10
Connecticut.						
Lake Konomoc		4.72	20			
North Franklin		3.47	21-22			
Voluntown		6.50	20	6.50	7 00	20
District of Columbia.						
Distributing Reservoir		2.52	26			
Receiving Reservoir		2.70	20			
Do		2.60	26			
Washington		2.71	25-26			
Florida.						
Bartow	10.58					
Eustis				1.68	1 30	6
Do				2.25	1 50	12
Fort Meade	10.45	2.50	22			
Jacksonville		2.71	16-17			
Jupiter	11.27	2.96	14-15	2.42	1 00	15
Do		5.24	*	1.85	1 03	30
Kissimmee		2.68	13			
Orlando		2.75	17			
St. Francis Barracks				1.30	1 00	11
Tampa				1.25	0 32	6
Do				1.15	0 40	11
Georgia.						
Atlanta				1.47	1 00	10
Dublin				1.03	1 00	2
Fleming		2.51	17			
Macon				1.26	0 28	10
Mauzy		5.79	11			
Savannah		3.82	17-18			
Illinois.						
Winchester		2.73	17			
Indiana.						
Columbia City		2.65	1			
Iowa.						
Keokuk		2.88	7-8			
Louisiana.						
Grand Coteau				1.15	0 45	2
Paincourtville		3.23	8			
Venice		2.83	14-15			
Do		2.52	17			
Maryland.						
Baltimore		2.50	19-20			
Do		2.90	25-26	1.00	0 53	25
Chestertown		2.90	19			
Coleman		2.62	8			
Easton		2.78	19-20			
Ellicott City		5.35	26-27			
Fallston		3.00	25-26			
Johns Hopkins Hospital		2.85	25-26			
McDonogh		3.80	26			
Queenstown		2.60	19			
Solomons		3.45	19-20			
Takoma Park		2.86	25-26			
Massachusetts.						
Amherst		2.98	1-2			
Attleboro	10.21	6.74	20			
Bluehill		4.57	20			
Boston		2.82	20			
Cambridge		3.01	20			
Chestnuthill		3.34	20			
Cohasset		4.34	20			
Fallriver		3.80	20			
Leeds		2.70	1-2			
Longplain		3.46	20			
Middleboro		3.73	20			
Plymouth		3.21	20			
Salem		2.86	20			
Somerset		3.81	20			
Taunton		4.41	20			
Weston		2.53	20			
Winchendon		2.77	2			
Michigan.						
Arbela		2.76	1			
Humboldt		3.31	6-7			
Ishpeming		2.75	6-7			
Newberry		3.00	10			
Port Austin		2.80	18			
Minnesota.						
Willow River		3.57	6			
Mississippi.						
Louisville				2.00	1 00	9
Port Gibson				1.59	1 30	6
Missouri.						
Downing				1.10	1 00	16
Eldon		2.76	17			
Galena				2.07	2 00	8
Mount Vernon		3.01	17			
Poplarbluff				1.47	0 40	8
Sarcoxie		2.95	17			
Wylie		2.83	17			
New Hampshire.						
Brookline		3.70	1-2			
New Jersey.						
Atlantic City		3.88	11	2.39	1 00	11

TABLE X.—*Excessive precipitation*—Continued.

Stations.	Monthly rainfall 10 inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
New Jersey—Continued.	*Inches.*	*Inches.*		*Ins.*	*h.m.*	
Atlantic City		3.24	19-20			
Elizabeth		2.52	11			
Flemington		2.94	11			
Lambertville		2.64	11			
Mount Pleasant		3.22	11			
Do		4.10	19-20			
Ocean City		3.10	19-20			
Perth Amboy		3.78	2			
Rocktown		3.40	11			
Staffordville		3.96	19-20			
Tuckerton		3.10	20			
New Mexico.						
Raton		2.50	14			
Roswell		3.48	8-9			
New York.						
Albany		2.87	25-26			
Caldwell		5.25	25-26			
Carmel		3.31	2			
Catskill		3.00	25-26			
Cherrycreek		2.55	1			
Cutchogue		6.63	20			
Glens Falls		4.44	25-26			
Greenwich		3.40	25-26			
Keene Valley		3.33	25-26			
Kings Station		4.56	26			
Lakehill		4.17	25-26			
Mayle		2.80	19			
Mohonk Lake		3.00	1-2			
North Germantown		2.52	25-26			
Port Jervis		2.57	25-26			
Saratoga Springs		5.84	25-26			
Schenectady	11.21	7.46	25-26			
Wappingers Falls		4.90	1-2			
North Carolina.						
Experiment Farm				1.27	1 00	6
Louisburg		3.40	9	3.40	1 15	9
Mountairy		3.19	19			
Rockingham		3.20	11			
Saxon				1.12	1 00	7
Oklahoma.						
Mangum		2.78	16			
Pennsylvania.						
Bethlehem		3.35	25			
East Mauch Chunk		2.57	25-26			
Ephrata		3.81	25-26			
Greensboro		2.85	10-11			
Seisholtzville		3.00	26			
Somerset		2.73	11			
Sunbury				1.20	1 00	8
Swiftwater		4.03	24-25			
Warren		3.56	1	1.57	1 00	1
Westchester		2.50	25-26			
Rhode Island.						
Kingston		4.00	20			
Lonsdale		5.89	20			
Narragansett		3.15	19-20			
Pawtucket		6.05	20			
Providence		6.50	20			
South Carolina.						
Batesburg				2.00	0 20	3
St. Georges				1.85	1 50	11
Smiths Mills		2.50	25-26			
Tennessee.						
Bluff City				1.46	0 55	7
Decatur				1.05	1 00	7
Greeneville		2.98	19-20			
Pope				1.55	1 00	9
Texas.						
Amarillo		2.94	7-8	1.01	0 48	7
Brownwood		3.00	17			
Grapevine	T			1.29	1 00	10
Hondo				1.00	0 15	11
Houston				1.13	0 50	10
Mann				1.72	1 15	17
Marathon				1.80	1 45	8
Mount Blanco				1.01	0 50	16
Rockisland				1.38	1 00	16
Vermont.						
Cornwall		2.81	26			
Norwich				1.03	0 20	3
Wells		2.58	26			
Virginia.						
Lexington		2.67	19			
Salem		2.80	19			
Scottsburg				1.65	1 15	9
Do		4.65	19-20	3.33	2 00	19
Do				1.32	1 00	20
Stanardsville				1.40	1 00	2
Warsaw		2.75	20			
Wisconsin.						
Bayfield				1.60	0 55	6
Cuba.						
Cienfuegos				1.56	0 40	23
Puerto Principe		2.72	17	2.63	0 35	17
Porto Rico.						
Bayamon	13.09	7.07	1-2			
Corozal	10.15					
Isabela		2.55	2			
Juana Diaz	10.05	5.84	1-2			

TABLE X.—*Excessive precipitation*—Continued.

Stations.	Monthly rainfall 10 inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
Porto Rico—Continued.	*Inches.*	*Inches.*		*Ins.*	*h.m.*	
La Isolina	15.53	5.80	1-2	.....	.....	.....
Lojas	.....	5.25	2	.....	.....	.....
Loquillo	14.98	.....	.....	.....	.....	.....
Manati	10.52	.....	.....	1.91	1.45	19
Puerto de Tierra	12.66	2.74	1	.....	.....	.....
San Juan	13.66	3.76	1-2	1.09	1 00	1
Do	.....	.....	.....	1.45	1 00	30

TABLE X.—*Excessive precipitation.*—Continued.

Stations.	Monthly rainfall 10 inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
Porto Rico—Continued.	*Inches.*	*Inches.*		*Ins.*	*h.m.*	
San Lorenzo	12.55	5.48	1-2	.....	.....	....
West Indies.						
Basseterre, St. Kitts	.....	3.43	8	.....	.....	.....
Bridgetown, Barbados	.....	3.73	13	3.27	1 01	13

* September 30—October 1.

TABLE XI.—*Data furnished by the Canadian Meteorological Service, September*, 1899.

Stations.	Pressure.			Temperature.				Precipitation.		
	Mean not reduced.	Mean reduced.	Departure from normal.	Mean.	Departure from normal.	Mean maximum.	Mean minimum.	Total.	Departure from normal.	Depth of snow.
	Ins.	*Ins.*	*Ins.*	°	°	°	°	*Ins.*	*Ins.*	*Ins.*
St. Johns, N. F.	29.86	30.00	.00	53.0	— 1.0	60.5	45.6	3.30	.....	
Sydney, C. B. I.	30.01	30.05	+.02	55.5	— 1.0	64.8	46.1	4.19	+0.95	
Halifax, N. S.	29.95	30.06	+.01	58.6	+ 1.0	67.0	50.1	3.20	−0.35	
Grand Manan, N. B.	30.00	30.05	+.01	56.6	+ 0.5	62.8	50.3	4.14	+2.34	
Yarmouth, N. S.	29.99	30.07	.00	56.5	+ 0.4	63.7	49.4	2.23	−0.36	
Charlottet'n, P. E. I.	29.98	30.02	.00	57.6	+ 0.3	65.5	49.8	4.06	+1.29	
Chatham, N. B.	29.99	30.01	.00	56.4	+ 1.0	66.8	45.9	2.01	−0.71	
Father Point, Que.	29.94	29.96	−.03	49.8	— 0.6	58.9	40.8	2.99	+0.19	
Quebec, Que.	29.67	30.00	−.02	54.0	— 1.1	61.4	46.5	3.06	−0.61	
Montreal, Que.	29.77	29.97	−.06	55.7	— 2.7	63.2	48.3	5.08	+1.85	
Bissett, Ont.	29.41	30.02	−.01	51.1	— 2.6	62.6	39.6	5.56	+1.86	
Ottawa, Ont.	29.67	29.98	.....	55.6	— 1.8	64.7	46.4	4.93	.....	
Kingston, Ont	29.69	30.00	−.04	58.2	— 1.8	66.4	49.9	3.95	+1.18	
Toronto, Ont	29.65	30.03	−.03	58.0	— 1.0	67.1	48.8	5.16	+2.41	
White River, Ont.	28.70	30.06	+.06	44.4	— 5.9	55.3	33.3	2.78	−0.30	3.4
Port Stanley, Ont	29.40	30.03	−.01	58.0	— 1.5	67.4	48.5	2.71	+0.06	
Saugeen, Ont.	29.32	30.03	−.01	55.8	— 1.7	63.7	47.9	2.76	−0.75	0.1
Parry Sound, Ont	29.32	30.01	−.02	53.7	— 2.3	62.5	45.0	3.34	−0.99	0.6
Port Arthur, Ont.	29.33	30.03	+.06	48.8	— 3.4	59.7	37.9	3.65	+0.18	
Winnipeg, Man.	29.18	30.01	+.08	52.7	+ 0.2	65.9	39.5	0.91	−1.09	
Minnedosa, Man.	28.22	30.01	+.08	51.6	+ 1.1	65.5	37.7	0.85	−0.57	0.1
Qu'Appelle, Assin.	27.75	29.98	+.05	53.0	+ 1.9	66.5	39.5	0.81	−0.33	
Medicine Hat, Assin.	27.73	29.97	+.08	59.1	+ 4.1	73.6	44.7	1.66	+0.81	
Swift Current, Assin.	27.47	30.01	+.06	55.0	+ 1.9	67.8	42.1	0.64	−0.49	
Calgary, Alberta	26.48	29.95	+.04	53.6	+ 3.8	66.7	40.4	0.99	+0.09	
Banff, Alberta	25.45	30.04	.....	49.8	.....	62.3	37.3	1.89	.....	
Edmonton, Alberta	27.68	29.94	+.03	53.2	+ 3.9	64.6	41.8	1.40	−0.09	
Prince Albert, Sask.	28.41	29.93	.....	52.4	+ 4.0	64.8	40.1	2.31	.....	
Battleford, Sask.	28.26	29.98	.....	54.0	+ 2.2	66.3	41.7	1.82	.....	
Kamloops, B. C.	28.83	30.09	.....	58.2	.....	67.5	48.8	0.52	.....	
Victoria, B. C.	30.03	.....	.....	57.0	.....	67.7	46.4	0.72	.....	
Hamilton, Bermuda.	29.89	30.05	+.01	76.6	— 0.8	81.4	71.8	8.11	.....	
Barkerville, N. W. T.	25.74	29.99	.....	49.4	.....	61.9	37.0	2.96	.....	

Chart I. Tracks of Centers of High Areas. September, 1899.

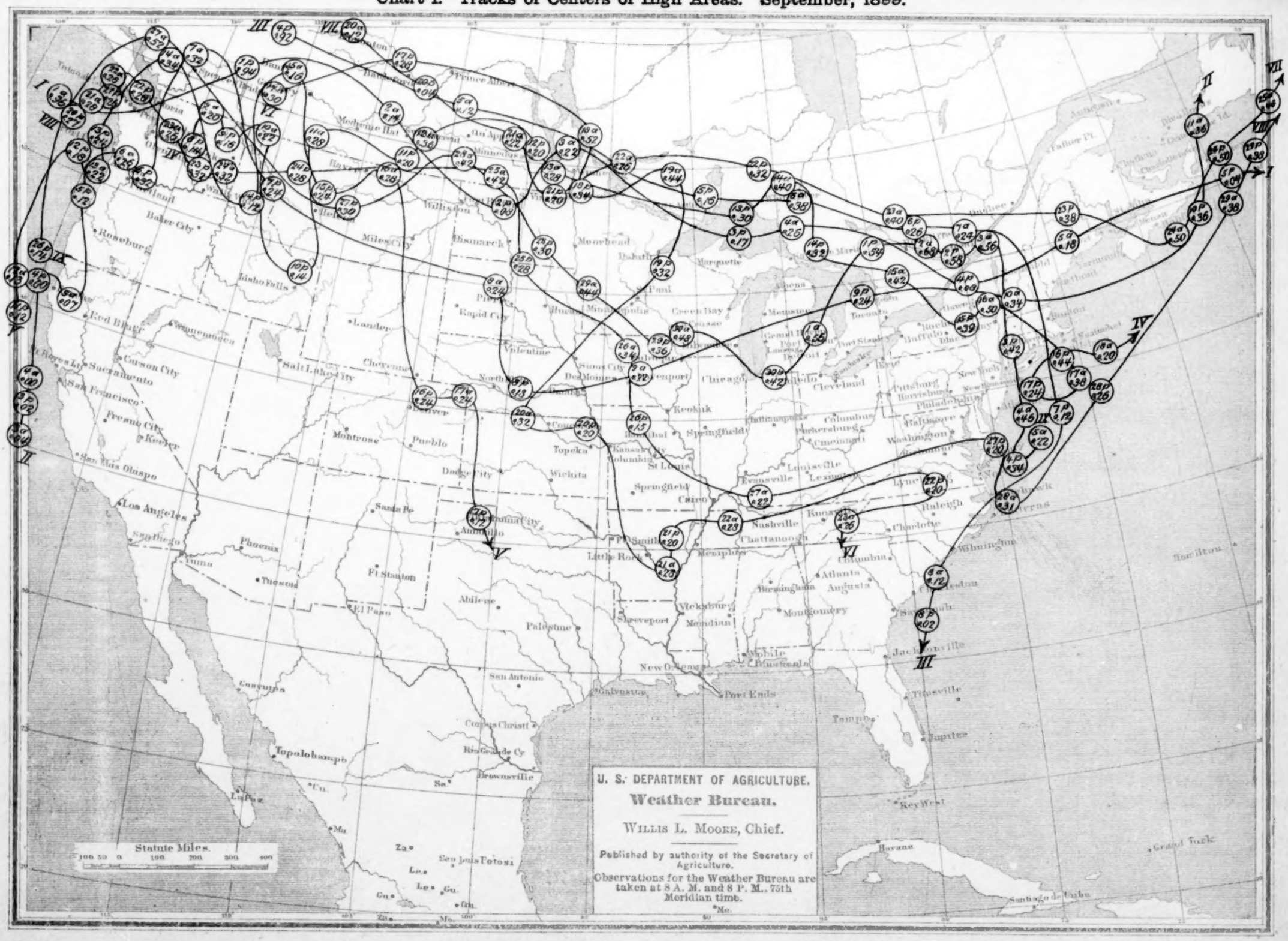


Chart II. Tracks of Centers of Low Areas. September, 1899.

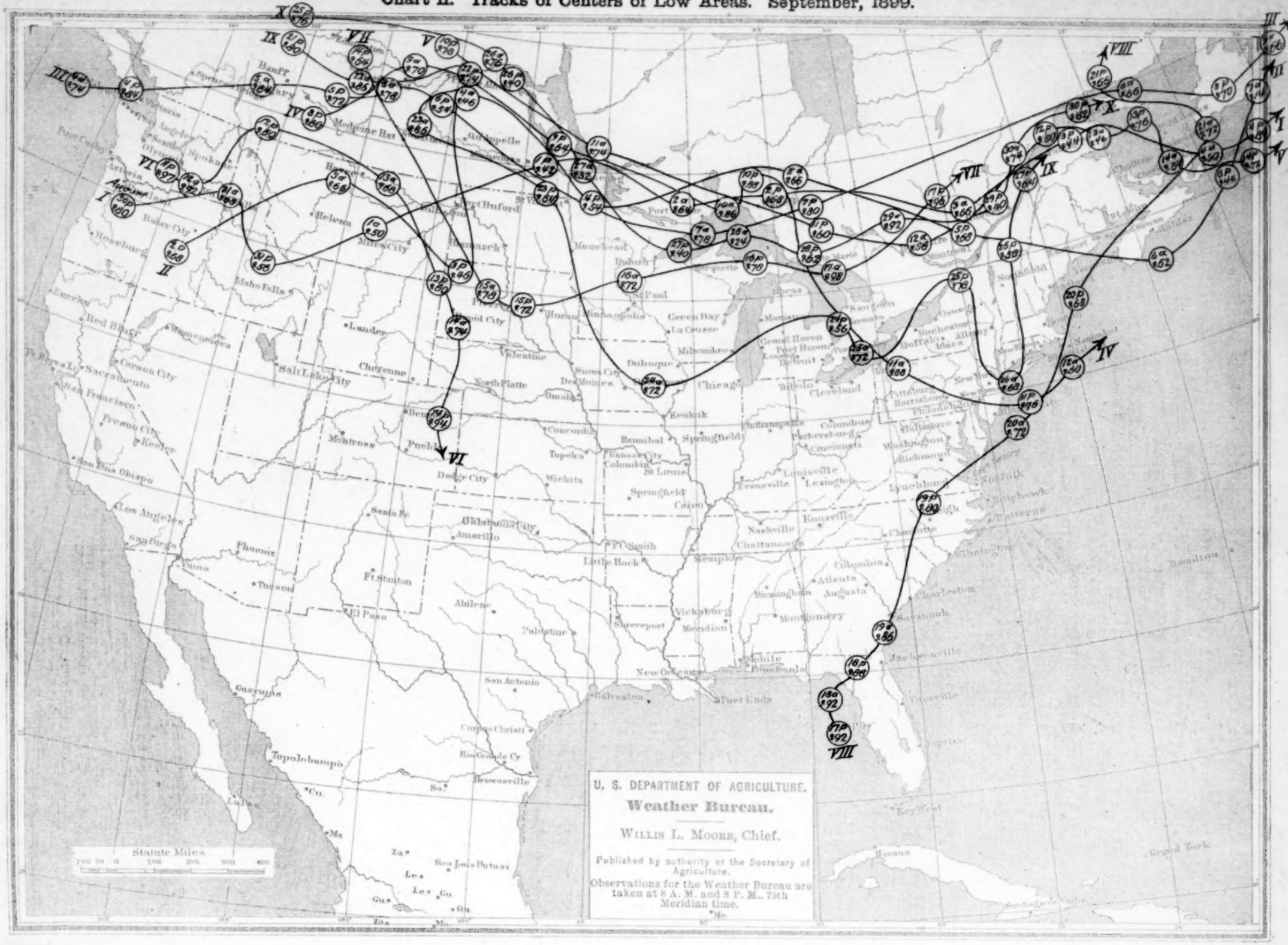

Statute Miles
U. S. DEPARTMENT OF AGRICULTURE.
Weather Bureau.
WILLIS L. MOORE, Chief.
Published by authority of the Secretary of Agriculture.
Observations for the Weather Bureau are taken at 8 A. M. and 8 P. M., 75th Meridian time.

Chart III. Total Precipitation. September, 1899.

Chart III. Total Precipitation. September, 1899.

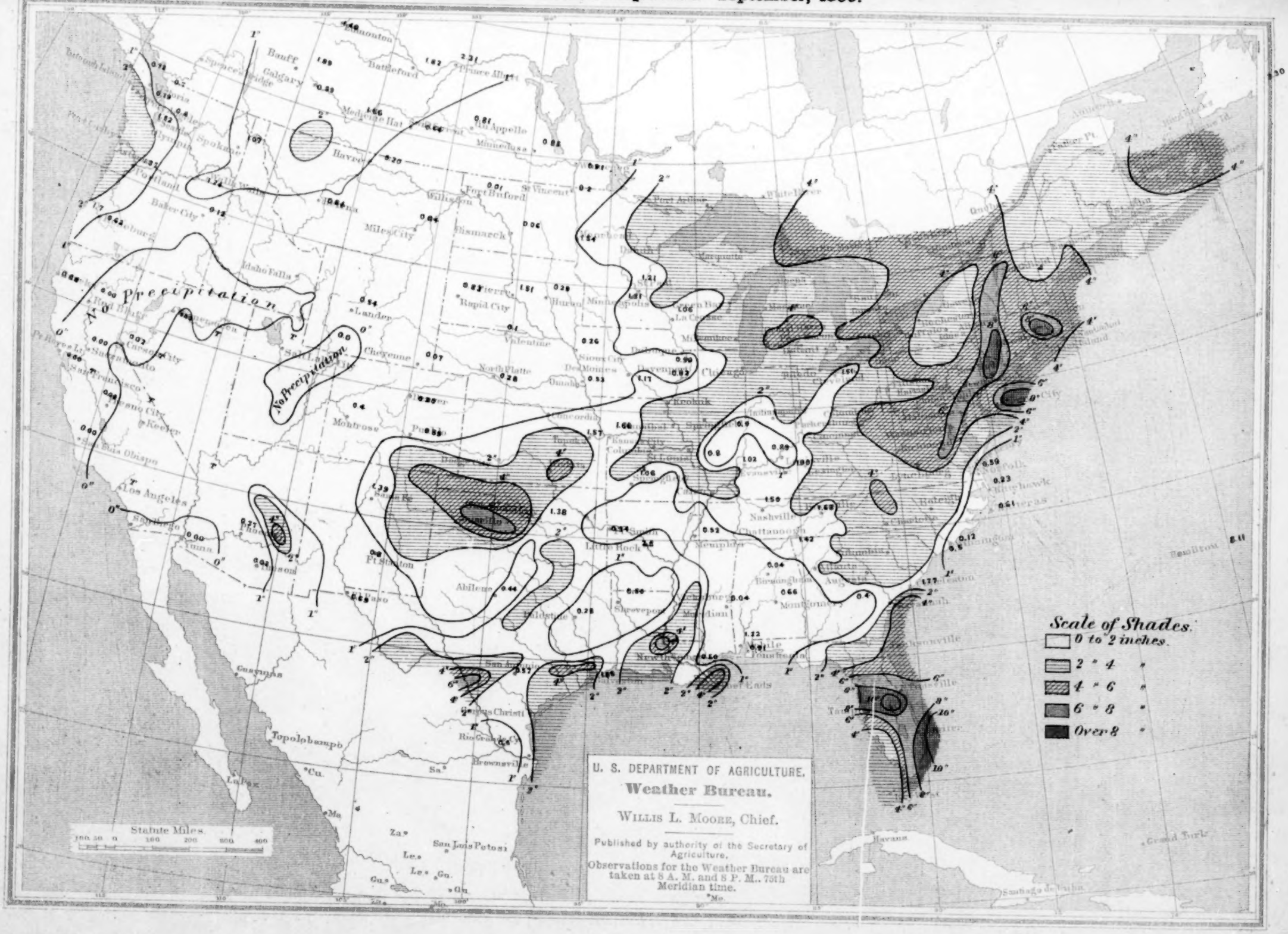
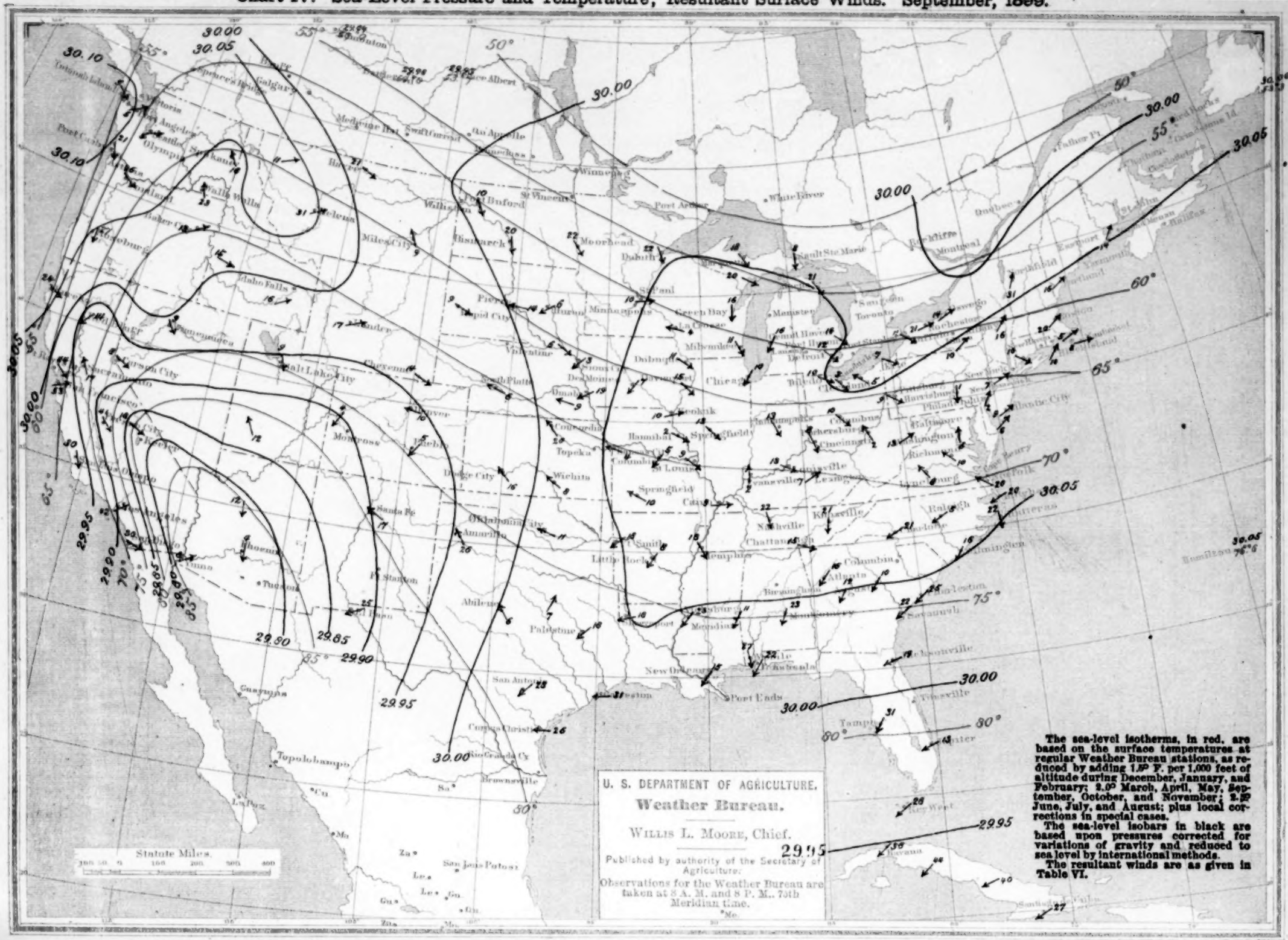

Precipitation
No Precipitation
Scale of Shades.
0 to 2 inches.
2 " 4 "
4 " 6 "
6 " 8 "
Over 8 "
Statute Miles.
U. S. DEPARTMENT OF AGRICULTURE.
Weather Bureau.
WILLIS L. MOORE, Chief.
Published by authority of the Secretary of Agriculture.
Observations for the Weather Bureau are taken at 8 A. M. and 8 P. M., 75th Meridian time.

Chart IV. Sea-Level Pressure and Temperature; Resultant Surface Winds. September, 1899.



The sea-level isotherms, in red, are based on the surface temperatures at regular Weather Bureau stations, as reduced by adding 1.5° F. per 1,000 feet of altitude during December, January, and February; 2.0° March, April, May, September, October, and November; 2.5° June, July, and August; plus local corrections in special cases.

The sea-level isobars in black are based upon pressures corrected for variations of gravity and reduced to sea level by international methods.

The resultant winds are as given in Table VI.

Chart V. Hydrographs for Seven Principal Rivers of the United States. September, 1899.

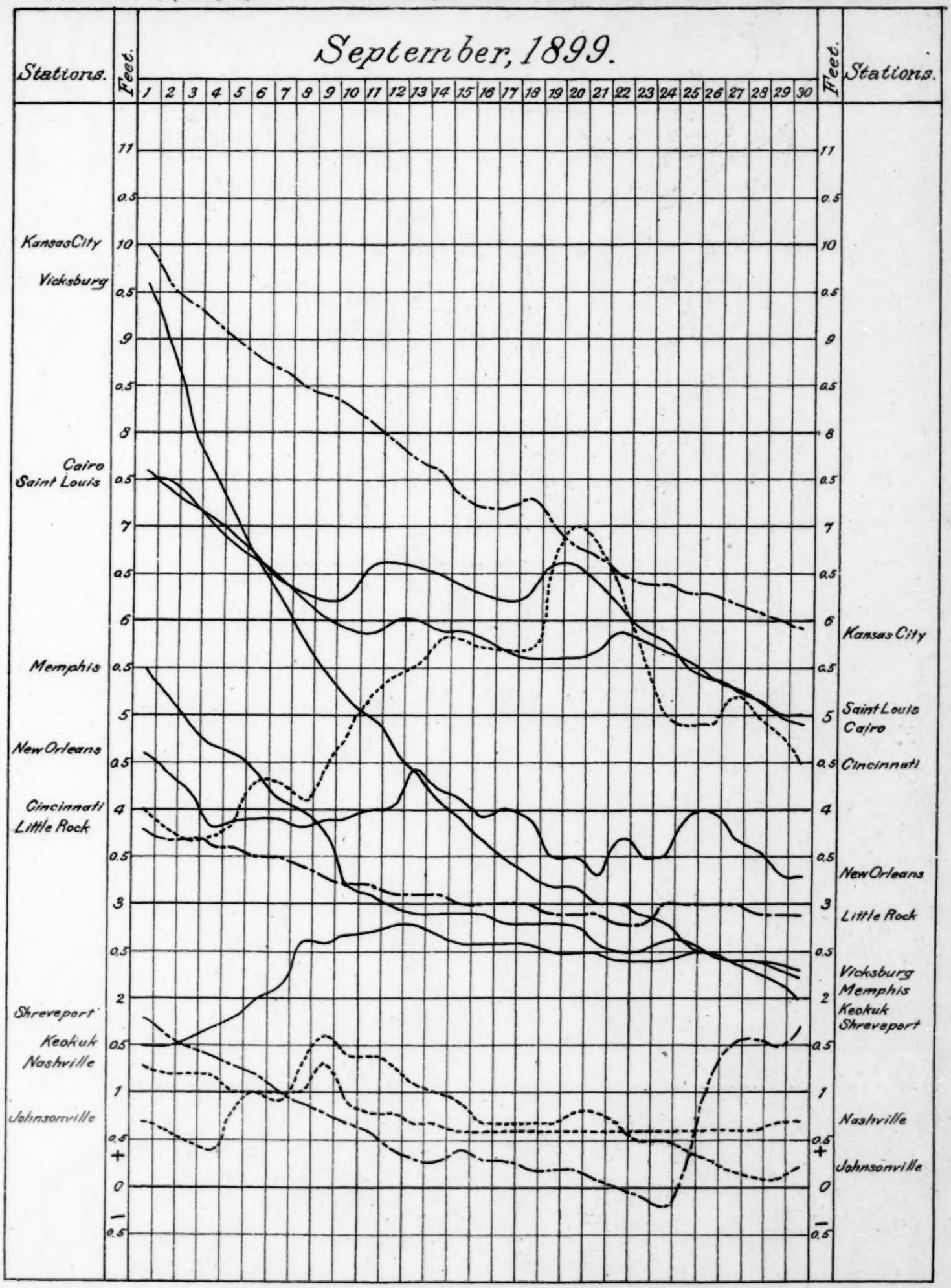


Chart VI. Surface Temperatures; Maximum, Minimum, and Mean. September, 1899.

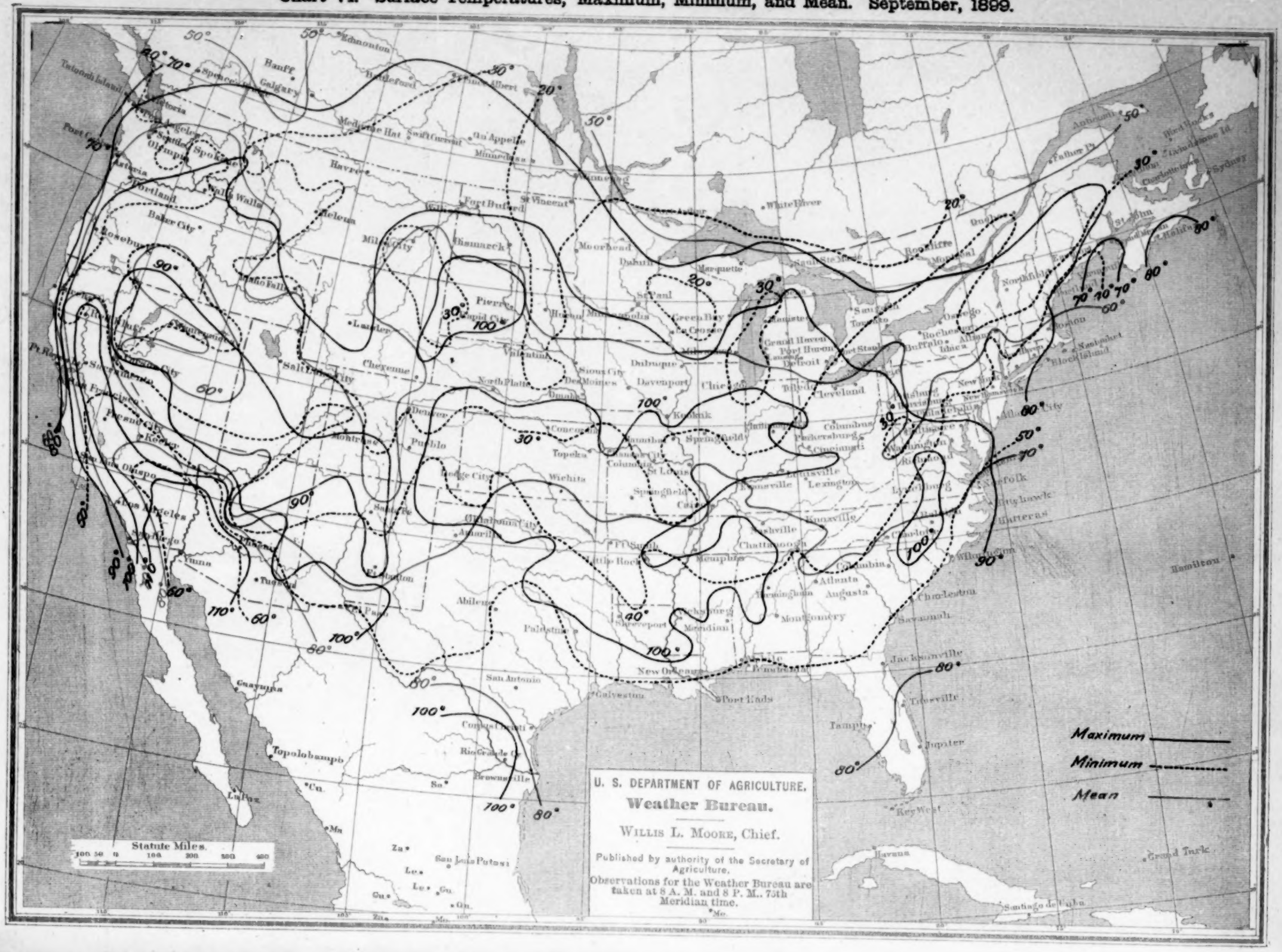
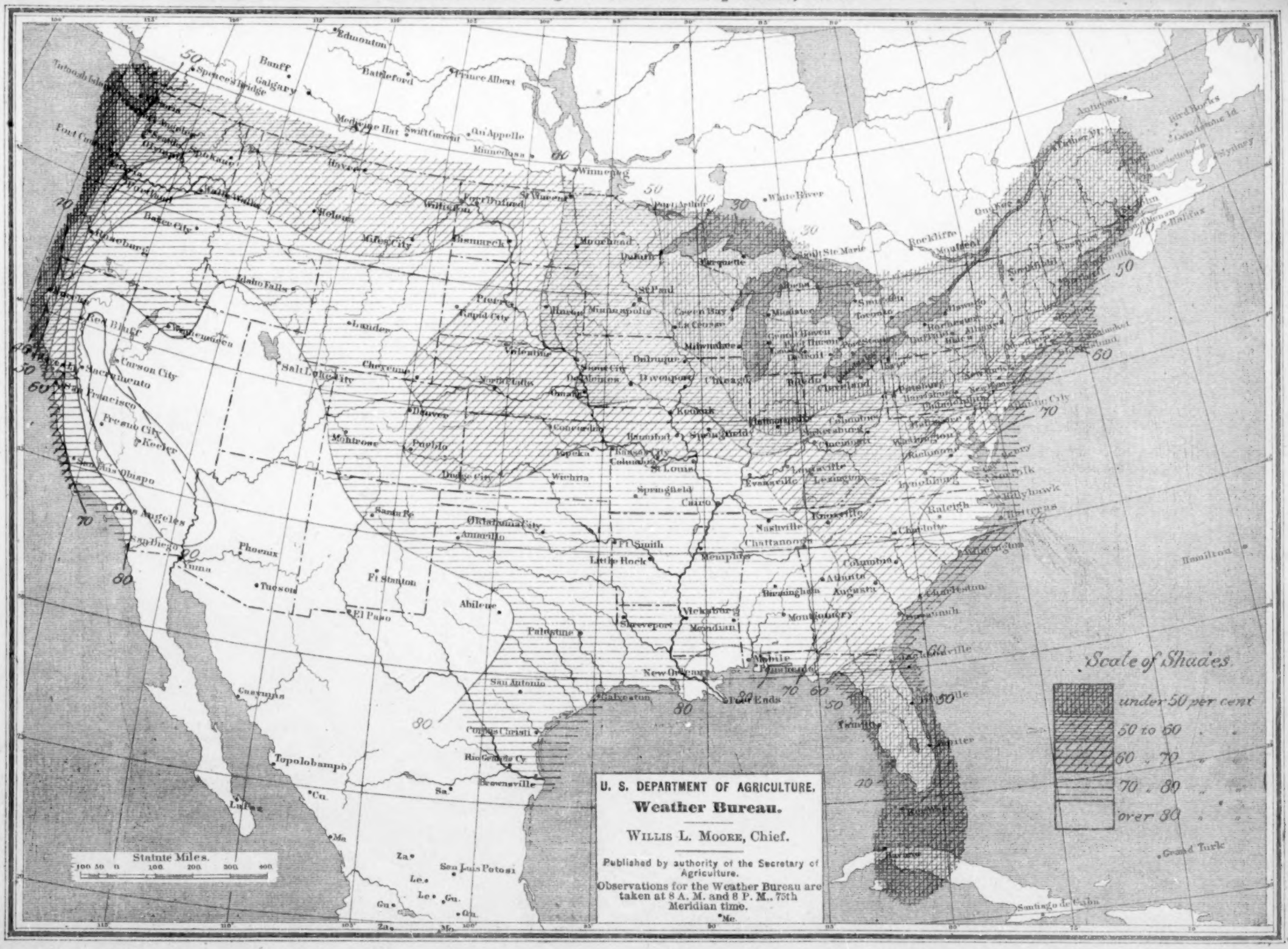

Statute Miles.
100 50 0 100 200 300 400
U. S. DEPARTMENT OF AGRICULTURE.
Weather Bureau.
WILLIS L. MOORE, Chief.
Published by authority of the Secretary of Agriculture.
Observations for the Weather Bureau are taken at 8 A. M. and 8 P. M., 75th Meridian time.
Maximum
Minimum
Mean

Chart VII. Percentage of Sunshine. September, 1899.

Chart VII. Percentage of Sunshine. September, 1899.



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Observations for the Weather Bureau are taken at 8 A. M. and 8 P. M., 75th Meridian time.

Chart VIII Total Snowfall for September, 1899.

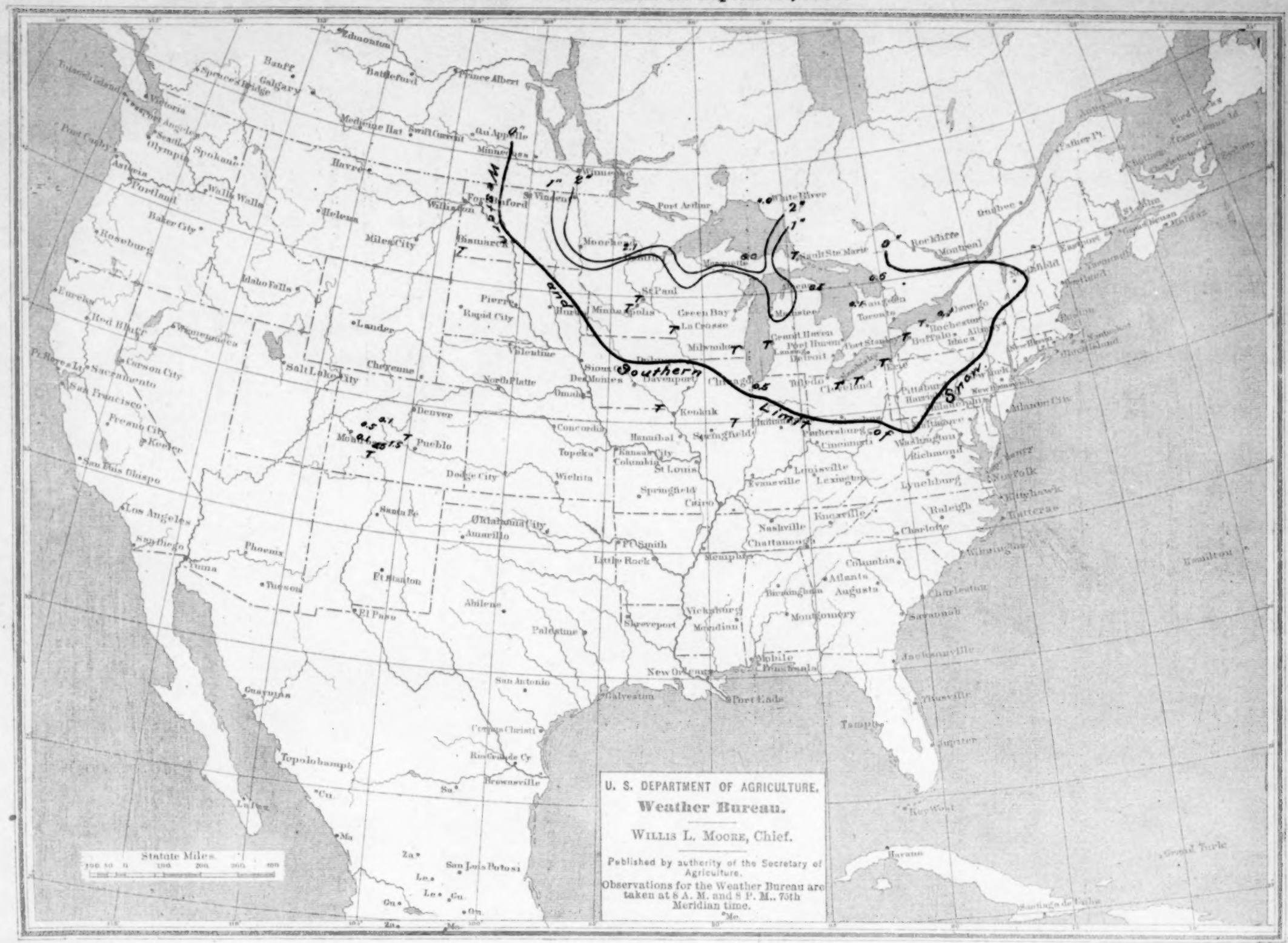
Northern Limit of Snow
Southern Limit of Snow
Edmonton
Banff
Calgary
Battleford
Prince Albert
Victoria
Medicine Hat
Swift Current
Qu'Appelle
Minnedosa
Spokane
Portland
Walla Walla
Helena
Miles City
Havre
Fort Buford
Williston
St Vincent
Port Arthur
White River
Moorhead
Sault Ste Marie
Rockliffe
Montreal
Quebec
St Paul
Minneapolis
Green Bay
La Crosse
Toronto
Buffalo
Rochester
Ithaca
Albany
Boston
Detroit
Cleveland
Pittsburg
Parkersburg
Washington
Richmond
Lynchburg
Norfolk
Hatteras
Raleigh
Charlotte
Wilmington
Knoxville
Nashville
Chattanooga
Columbia
Atlanta
Augusta
Charleston
Savannah
Jacksonville
Tampa
Key West
Havana
Mobile
New Orleans
Pensacola
Galveston
Port Eads
Vicksburg
Meridian
Shreveport
Montgomery
Birmingham
Little Rock
Memphis
Ft Smith
Evansville
Louisville
Lexington
Springfield
Cairo
Indianapolis
Cincinnati
Columbus
Toledo
Erie
Buffalo
Rochester
Albany
Boston
Portland
Bangor
Halifax
Yarmouth
Sydney
Father Pt
Anticosti
Gaspé
Chicago
Milwaukee
Detroit
Grand Haven
Port Huron
Duluth
Winnipeg
Moorhead
Minnedosa
Rapid City
Huron
Pierre
Bismarck
Miles City
Glendive
Billings
Helena
Havre
Fort Buford
Williston
Medicine Hat
Swift Current
Qu'Appelle
Prince Albert
Battleford
Edmonton
Banff
Calgary
Spence's Bridge
Victoria
Tatoosh Island
Port Crescent
Seattle
Olympia
Spokane
Portland
Astoria
Walla Walla
Baker City
Roseburg
Eureka
Red Bluff
Pt Reyes Lt
Sacramento
San Francisco
Fresno City
Keeler
San Luis Obispo
Los Angeles
San Diego
Yuma
Phoenix
Tucson
Santa Fe
Ft Stanton
El Paso
Oklahoma City
Amarillo
Abilene
Dodge City
Wichita
Topeka
Kansas City
Columbia
St Louis
Hannibal
Springfield
Concordia
Omaha
North Platte
Cheyenne
Denver
Pueblo
Salt Lake City
Idaho Falls
Pocatello
Winnemucca
Carson City
Landers
Eureka
Roseburg
Portland
Astoria
Port Crescent
Tatoosh Island
Victoria
Seattle
Olympia
Spokane
Walla Walla
Baker City
Helena
Miles City
Havre
Fort Buford
Williston
Minnedosa
Winnipeg
Moorhead
Duluth
Grand Haven
Port Huron
Detroit
Cleveland
Buffalo
Rochester
Albany
Boston
Portland
Bangor
Halifax
Yarmouth
Sydney
Father Pt
Anticosti
Gaspé
Quebec
Montreal
Rockliffe
Sault Ste Marie
Toronto
Port Arthur
St Vincent
Moorhead
Bismarck
Huron
Pierre
Rapid City
Miles City
Billings
Glendive
Helena
Havre
Fort Buford
Williston
Minnedosa
Winnipeg
Moorhead
Duluth
Minneapolis
St Paul
Green Bay
La Crosse
Milwaukee

Chart IX. West Indian Monthly Isobars, Isotherms, and Resultant Winds. September, 1899.

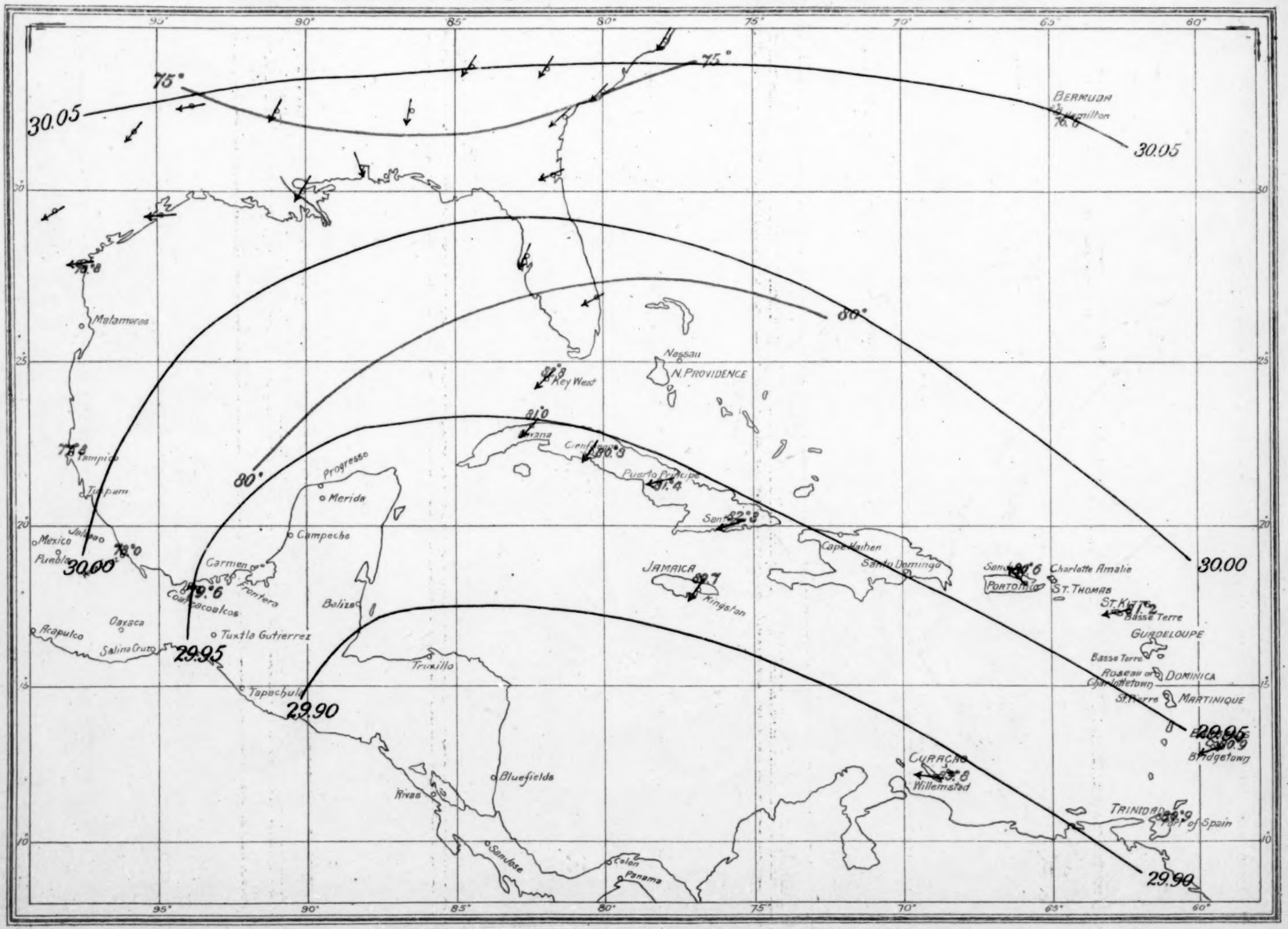

Chart X. West Indian Hurricane Tracks for September, 1899.

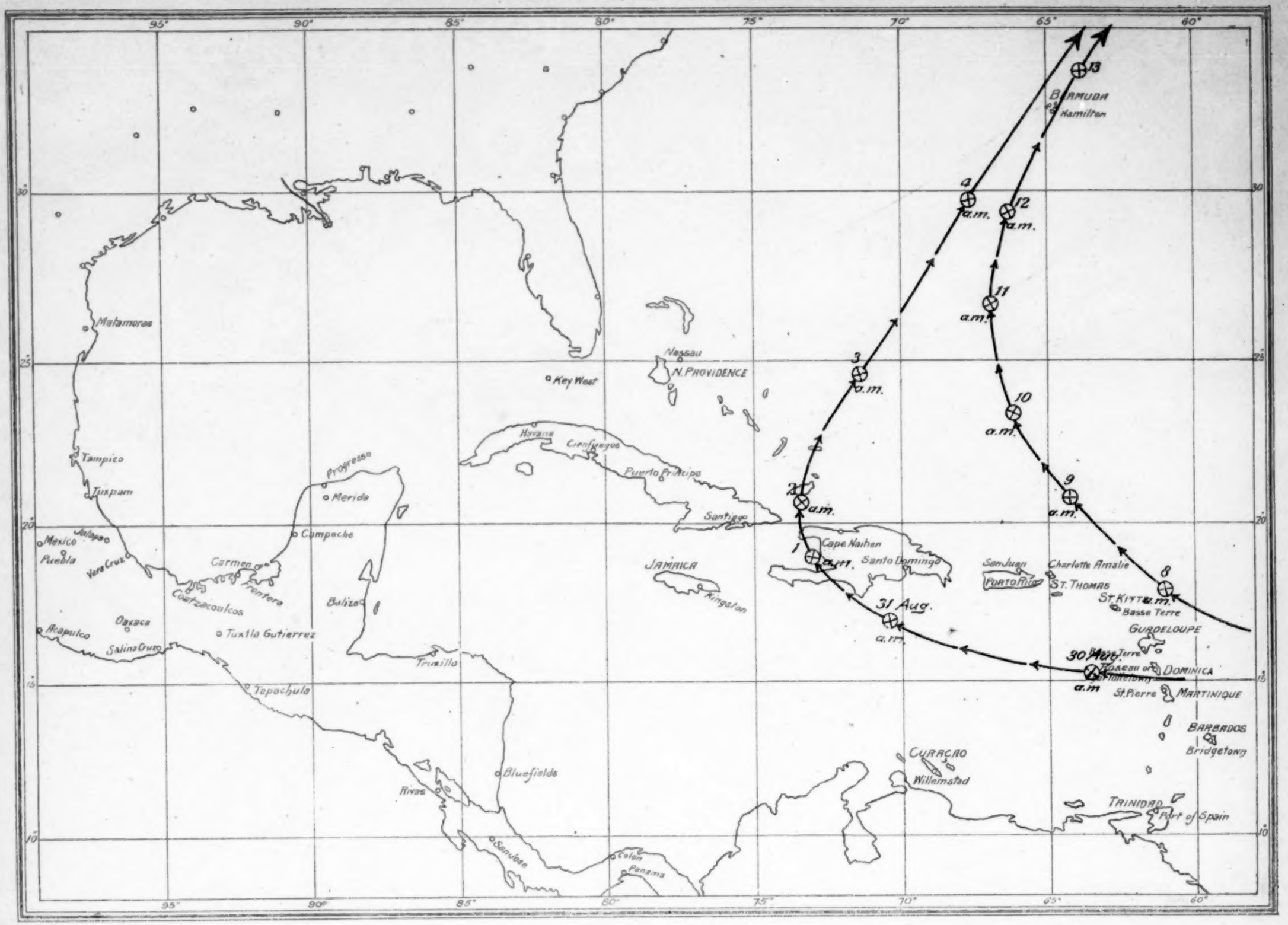
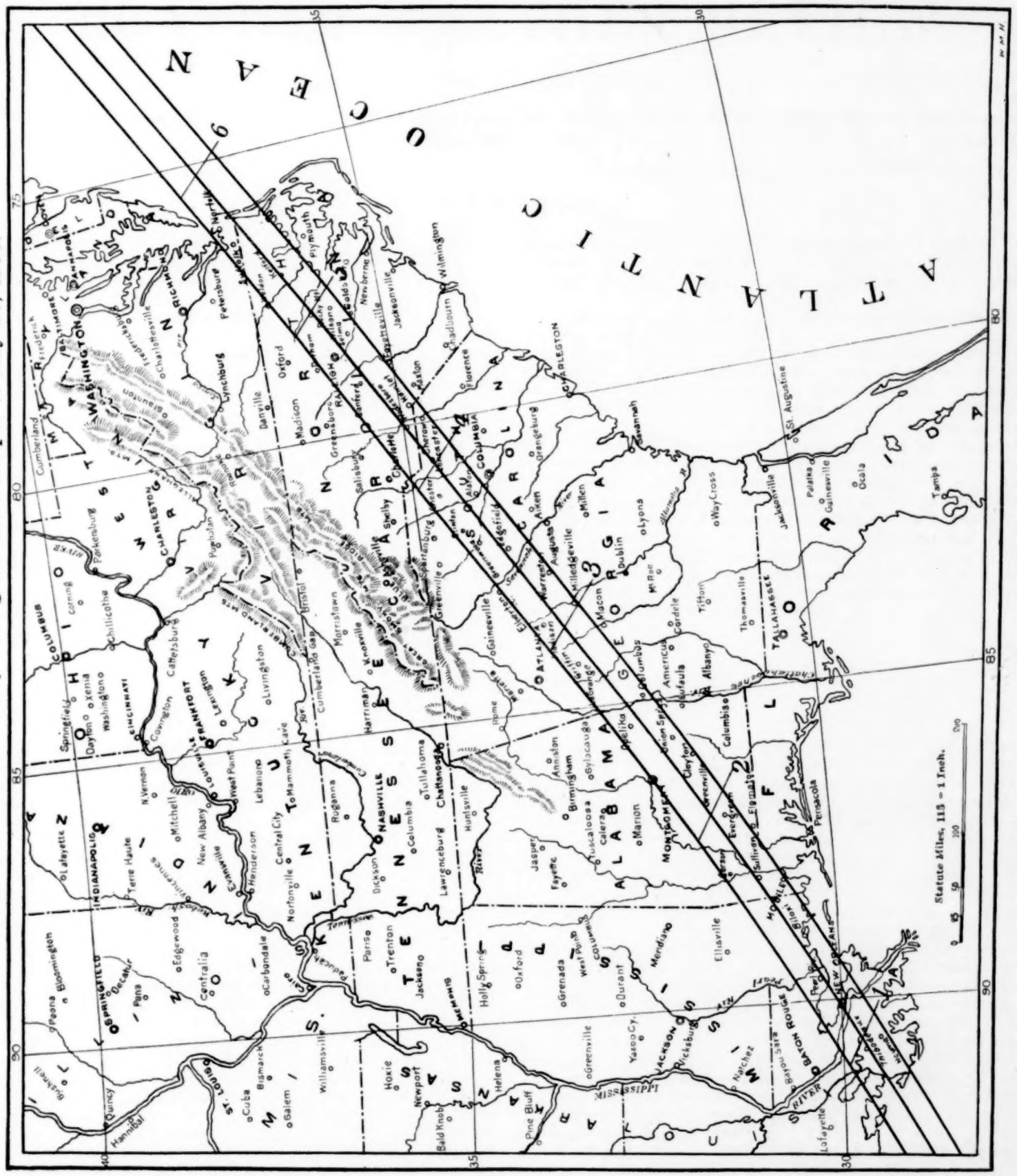
Chart XI. Path of Totality During the Solar Eclipse of May 28, 1900.